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STREET PAVEMENTS IN EUROPE.

In no section of Europe are all the different kinds of pavement in use found in the same degree of perfection. In Middle France and Holland one finds first class brick pavements. In different parts of Holland they are laid with varying degrees of success. In the towns where expense affects the character of the foundation, we find a corresponding departure from the best results. Where the pavements are laid on sand they are more or less uneven, and to that extent unsatisfactory. The Holland brick pavements are the best pavements found in that section. A brick pavement on a sand foundation is, on some accounts, better than stone or other pavement of the same general character laid on a similar foundation. In Amsterdam one sees brick pavements on a rigid concrete base, and laid under the varying conditions which only present themselves in a great city. They are found on streets where there is heavy teaming, in other sections where they are used for light driving, and oftentimes between the street-car tracks and jutting squarely up against the rail. When we bear in mind that the rail is flat on the top, excepting for the groove in which the flange of the wheel runs, it is easily seen that any little settling of the brick or of the foundation under it would make a very unsatisfactory condition for travel. But on the concrete base, with the spaces between the brick filled in with Portland cement, there is presented an absolutely rigid surface; and it is such a foundation which gives the best results in the brick pavements of that city. In the city of Blois, in Middle France, are also found brick pavements of a high character. The streets in certain sections are rather undulating and often quite steep, and in a number of these may be

found brick pavements on a rigid concrete base and with the joints between the brick filled in as described. The surface and the general character of the covering is ideal as such things go.

In Paris at this time one finds brick pavements used only in courts, carriage approaches, sidewalks, stables, areas and other locations of this general character. One finds, however, in this city a kind of brick pavement not common to the other sections. The brick are in 4-inch cubes with the edges beveled, and by setting them in diagonal patterns and varying the color of the brick, very beautiful floors for courts, sidewalks and stables are secured. A very common combination is red and buff, with the occasional use of chocolate. Very beautiful effects are derived by this arrangement. The beveling of the brick at the corners makes a joint which is supposed to prevent horses slipping when starting with a heavy load. All of these pavements rest on a solid concrete foundation.

Glasgow is a city where very few experiments in paving have been tried. In one or two streets wood pavements and a few sections of asphalt are to be seen. The common pavement in Glasgow is granite block laid on a concrete base. No sand or other material is laid between the under covering and the granite. The base itself is usually made of broken stone and Portland cement, though at times broken stone and pitch are used. One nearly always finds pitch run in between the stones as they are laid. Thus they have an unyielding foundation, and the stones are secured one to the other in a solid unyielding manner. This is the Glasgow pavement and the only one which is received with much favor in that section. When the blocks wear out they are replaced by new ones, and the discarded ones are redressed and used in sections of the city where the travel is less heavy. Oftentimes they find a place in courts, if not in unfrequented streets.

In Liverpool there is a greater variety of pavement, though one finds very few in a highly satisfactory condition. The streets of Liverpool are not so well cared for as those in Glasgow or even London; and wherever one finds this the case, he may be sure that the engineering is to some extent defective. Where streets are regularly cleaned, the defects in the laying of pavements are shown and a higher degree of service promoted. In Liverpool there is a

good deal of mud and dirt on the streets, and because of this neglect one may know that the foundation and the coverings themselves are defective. The two conditions go together.

In London one finds everything in the way of pavements—stone, wood, asphalt, macadam and some brick—though the latter covering has never been properly tested in that section. It has been put down in neglected quarters, on inadequate foundations, and never well cared for. One finds stone and wood pavements resting on all kinds of foundations; sand, concrete, combinations of sand and concrete, and occasionally sand foundations over which boards covered with tar are laid. The wooden blocks rest on the boards. Such pavements have been used to secure a minimum of noise from travel. In London one will find the greatest variety of asphalt coverings. With a concrete base, and the powdered asphalt compressed in the manner common to that part of the world, the results are the best. It is safe to say that there has been more experimenting with pavement foundations in London than in any city in the world. One can hardly think of a combination of material which has not been used. However this period of experimenting is about at an end. The pavements regularly and successfully in use are granite blocks on a rigid concrete base, wood blocks on a similar foundation, and powdered asphalt rock on a concrete base. On such a foundation the surface covering can be removed and replaced when it becomes necessary; and it is well known that any covering will in time give way under constant wear.

It is in matter of repairs that nearly all American cities are weak. It must be known that there is no such thing as an everlasting pavement. This fact in itself should suggest an organization for repairing streets which is quite as effective and yet more prompt to act than that which has to do with the building of new streets. In any of the great cities of the old world one notes a constant patrol of the pavements with a view of detecting imperfections and caring for them while they are yet slight. Thousands upon thousands of dollars worth of good pavement in our American cities is ruined for the want of a little attention and prompt care at the time when slight defects appear. Experience in European cities has shown that a block pavement can be made to wear down thin, without ruts, by merely removing and renewing bad

blocks. This is true of both stone and wood. The asphalt pavements are followed up so closely that they do not show the patchwork which is common to neglected coverings of this character. Nothing pays so well as prompt repair and attention in caring for our streets.

STREET CAR RAILS, ETC.

Since the introduction of electricity as a motive power in street car service a new problem has developed in connection with the laying of heavy rails in the streets. A motor which weighs ten or fifteen tons and rests on four wheels which come so close together, concentrates great weight on a relatively small area. We now have the heavy girder rail and the sleepers or ties bedded in concrete. Where a rail does not have the proper foundation, it affects the character of the street covering next to it. There can be no doubt that many good streets are injured because of an insufficient foundation underneath or in connection with the rails. An engineer who has given this matter some little attention says that all rails for electric service should rest on a concrete base, though he mentions the fact that broken stone filled in with bitumen may answer measurably the same purpose, and give, at the same time, a suitable foundation somewhat less rigid than the concrete. He suggested this idea more in deference to the demands for a foundation which has a little spring to it than because of the dictates of his own judgment. He also states that a great deal of money is being thrown away on inadequate foundations, and that many expensive renewals will be required within the next few years. The worst of all this is that there will be not only the expense of putting in the foundation, but the cost of a new covering. Street building and the work connected therewith is not growing less complicated. Rapid transit has made great extensions in the limits of cities. There is wide territory to be covered with streets; hence a temptation to seek something cheap. As we all know that as a good street is never cheap, we may here note a danger.

Louis H. Gibson.

LOUIS H. GIBSON.
Biographical Sketch in January Number, 1898, page 15.

MONEY VALUE OF GOOD ROADS TO FARMERS.

THAT good roads have a money value to farmers will be granted by all. That the *money* value of improved highways is *alone* sufficient to justify the cost of their construction, will be confidently claimed or readily admitted by many farmers, questioned by others and denied by not a few.

In view of the financial and many *other* advantages of good roads, doubtless a majority of the farmers of the state would favor their construction, as rapidly as practicable, under some efficient, economical and equitable system of highway improvement. But there is a considerable proportion of the farmers—doubtless one-fifth and possibly one-fourth—who have little knowledge or appreciation of the benefits of good roads, and who, therefore, gloomily contemplate the great cost of highway improvement. The farmers of this class know that they will have to bear their full share of the burden of such improvement; they discredit (not wholly without reason) the statements and conclusions of many public writers as to the losses and gains to farmers from poor and good roads respectively, and, hence, they view with apprehension the general agitation in favor of improved highways. Ignoring or undervaluing the educational and social advantages, as well as the comfort and enjoyment of good roads, or feeling unable to pay the price of such benefits, these farmers regard with distrust and disfavor measures for highway improvement, and they are likely to oppose efforts for the betterment of our roads unless they can first be convinced that *good* roads will prove a paying *financial* investment. Speaking, therefore, in behalf of those who, for any reason, are not influenced by the higher considerations in favor of improved highways, I raise the question, will it pay the farmers, in dollars and cents, to improve their public roads? Before attempting to answer this question, let us consider in what ways permanently good roads will prove financially beneficial to farmers. All will agree, I think, that a good road will:

1. Economize time and force in transportation between farm and market.

2. Enable the farmer to take advantage of market fluctuations in buying and selling.

3. Permit transportation of farm products and purchased commodities during times of comparative leisure.

4. Reduce the wear and tear of horses, harness and vehicles.

5. Enhance the market value of real estate.

But while it is easy to enumerate the ways in which improved roads would be financially advantageous to farmers, it is very difficult to estimate, in dollars and cents, the benefits to accrue therefrom. Distrusting my own judgment in the premises, and fearing also that my opinions would have little weight with others, I sought the advice of the farmers themselves. Letters of inquiry were sent to sixty of the most intelligent farmers in forty counties located in the central and northern parts of Indiana. The substance of these letters is given herewith:

"1. About what proportion of the public highways in your county are now good gravel roads?

"2. Please estimate the average increase (in dollars and cents) in the selling price per acre of land throughout the county, as the result of such gravel roads.

"3. If *all* the public roads in your county were converted into improved highways, how much, in your judgment, would it increase the average selling price per acre of land throughout your county?

"4. What would be a fair estimate of the cost per mile of converting our common dirt roads, as they now exist, into good gravel roads, provided, of course, the work were to be performed economically under some competent, general supervision, and not hampered by legal restrictions?

"5. Supposing that your county were divided into 100-acre farms, and that the average distance of each farm from market were five miles, what, in your judgment, would be the average annual cost (in dollars and cents) to each farmer, of our unimproved highways?

"In answering the fifth question please take into account the reduced loads, increased time, extra wear and tear, and loss in sales from inability to deliver products when the market is best."

Over forty replies to these queries were received. As would be expected, from the difference in soil, surface and distance from gravel beds, there is a wide range in the estimates of the different

correspondents. Many of the estimates are necessarily mere guesses, while others are based on a thorough knowledge of the matter under consideration. Although it is extremely difficult to reduce the replies to definite figures, which must of course largely exclude explanatory statements and thereby do injustice to correspondents, so much interest attaches to the estimates given that I venture to set forth the same in tabular form. The letters being private, the names of the correspondents are of course withheld.

TABLE, *Giving Estimates by Farmers of the Cost of Gravel Roads, the Enhancement in Value of Land Therefrom, and the Annual Loss from Poor Roads.*

COUNTY.	Roads now Improved.	INCREASE IN VALUE PER ACRE.		Av. Cost per Mile of Gravel Roads.	Av. Loss per 100 Acres from Poor Roads.
		From Roads now Improved.	If all roads were improved.		
Tippecanoe	65 %	Nothing.	Nothing.	$1,320	Nothing.
Porter	None.	.....*	$5 and over.	500†	$50
Howard	15 %	$1 75‡	10	1,700	65
Hamilton	20 %	2 to 3‡	5	1,000 sub.	25
DeKalb	None.	.....*	10	400	....*
Rush	50 %	5 along the r'ds.	5	1,000	50
Marion	12½	Nothing.	Nothing.	2,500	....*
Elkhart	10 %	.....*	At least 10.	1,200 to 1,500	100 to 150
Cass	7 %	8 to 10	15 to 20	800	40
Montgomery	20 %	1‡	3	1,200	....*
Clinton	33⅓	10 along the r'ds.	10 to 15	1,800 past ex.	30 to 50
Knox	33⅓	.....*	33⅓ %	750 to 1,500	65
Randolph	12½	5	10	1,500	....*
Boone	80 %	10	10	.....*	50
Putnam	25 %	3 to 5	5	1,000 to 1,200	100
Fayette	300 mi.	100 %	30 %	500	100
Wayne	33⅓	10	$15	700	100
Delaware	40 %	10	.... *	1,000	100
Newton	None.	.....*	10	2,000	50
Montgomery	300 mi.	5	5	1,000	100
Hendricks	20 %	5	5 to 8	800 to 1,000	25 to 35
Whitley	5 %	.....*	20 %	1,500 to 2,000	100
Noble	10 %	.....*	.....*	10,000§	....*
Morgan	10 %	10 to 20	10	600	100
Decatur	8 %	1.50 to 2.00‡	5	1,500 to 2,000	10 to 20
Hancock	Over 30 %	8 to 12	10 to 15	700	100
Bartholomew	20 %	5 to 10	At least 10 %	4,000	75
Kosciusko	None.	.....*	$6	.....*	300
Tipton	30 %	5	10	1,600	....*
Wells	20 %	$10	25	1,500	75
Blackford	25 %	10	15	1,400	100
White	10 %	5 to 8	10	1,000 or over.	200
Benton	..... *	.....*	.....*	1,500 to 1,600	....*
Huntington	20 %	5 to 10	10	300 to 1,800	50
Fountain	5 %	5 adjacent.	2.50	600 to 800	30 or more
Hamilton	65 %	6	7	580 from exper.	100
Wayne	About 75 %	10	About 10	Here 800	50
Jay	15 %	2 to 10	10	600 to 800	About 25
Warren	About 100 mi.	5	5 to 10	1,200	100
Marshall	12½	10	25	700	50
White	4 %	5 to 10	10	500	100 calcu.
La Grange	33⅓	Nothing.	Nothing.	400	10

* Not estimated. † Not gravel. ‡ Average of all land in county. § Includes very heavy grades.

The averages of the estimates contained in the foregoing table should give—and they probably do give approximately—the con-

census of opinion, held by the most intelligent farmers of our state, as to the cost and money value of improved highways and the loss due to poor roads.

The approximate averages for the forty counties included in the table are as follows:

First. The average estimated increase in the selling price of land due to existing improved highways is $6.48 per acre. The estimates from which this average is made refer in most cases to lands near the improved roads; but, in a few instances, they apply to all the lands of the county. The average increase, therefore, of $6.48 per acre is lower than was intended for the lands near the improved roads.

Second. The estimated average increase per acre that would result from improving *all* the public roads is $9.00.

Third. The estimated average cost of converting the common public roads into improved highways is $1,146 per mile.

Fourth. The estimated average annual loss, per 100 acres, from poor roads is $76.28.

If these estimates are even approximately correct, they furnish a key to the satisfactory solution of the question of highway improvement from the money standpoint. On the basis of the last mentioned estimate the average annual loss per acre from poor roads is over 76 cents. In five years the losses would aggregate $2,432 for every section of land, and this sum would construct two miles at a cost of $1,216 per mile, which is $70 per mile above the estimated average cost given by the farmers themselves. The present road tax which, under existing laws, is largely thrown away, would, under a proper system of road maintenance, doubtless keep improved highways in perfect repair.

If the foregoing statements are a near approach to the truth, it follows that the losses and expenditures which farmers actually incur on account of poor roads would also secure permanently good roads. Can any sane mind doubt the financial wisdom of exchanging the losses, delays, accidents and vexation of spirit occasioned by bad roads, for the comfort and other advantages of good roads?

But there is another side to this question, viz.: The increased value of land from highway improvement. As already stated, this increase is estimated by the farmers consulted at $9.00 per acre.

This would enhance the value of each section of land $5,760, which is more than double the estimated cost ($2,292) of the two miles of improved highway, which constitute the quota for the section. Just here the objection may be raised that the improved roads would not increase the *productive capacity* of the land, while the enhanced *commercial value* would increase the taxes. Let us, for the sake of argument, grant this plausible but fallacious objection, and then find what it amounts to. Let us suppose the increase in appraisement for taxation to be $4.00 per acre, and the tax rate 1¼ per cent. This would mean an annual *increase* in taxes of five cents per acre, or $5.00 per hundred acres. Would not our objector, after enjoying the benefits of good roads, be very willing to give therefor the extra $5.00, if necessary? Would he keep the money and go back to the thralldom of mud roads? If so, he has the option of selling his farm *at an advance*, according to the average estimates of his brother farmers, that will more than doubly reimburse him for his expenditure on highway improvement; and he can then remove to some native wild whose quiet waters have not been "troubled" by the spirit of progress. I am aware that many intelligent farmers will not accept the estimates of their fellow farmers as to the money value of good roads—many who will even deny that improved highways have *any appreciable* money value. I am glad to know, however, that many of these very same farmers favor good roads, and would aid in their construction for the same reason that they would build for themselves comfortable and even luxurious homes.

In view of the very general recognition among farmers of the necessity and benefits of good roads, I am encouraged to believe that a very large proportion of the farming classes will heartily join with the people of the cities and towns in an effort to devise, adopt and put into execution some efficient, economical and equitable system of highway improvement. *W. C. Latta.*

SEWAGE DISPOSAL.

IV.

COVENTRY.

The sewage works at Coventry are very well administered, there being an intelligent, well-informed man in immediate charge as superintendent.

The town has a population of about 55,000, and the average daily amount of dry weather sewage is nearly 2¼ million gallons, including factories; about forty gallons per head. Rain water is received from the streets. The sewers have storm water overflows and the main inlet sewer at the station has also an overflow sill for discharging the excess, above a fixed amount, directly into the adjacent street. The stream is so small that the effluent from the settling tanks has to be passed through filtering beds before being turned into it. It is a good illustration of the extreme need for sewage treatment in England, with its dense population and small water-courses. The dry weather flow of the stream, as actually gauged some 3 or 4 years ago, was only about two million gallons, absolutely less than the dry weather flow of rich sewage. At the time I saw it, it was a mere trickling little stream which the superintendent told me was much smaller than when the measurement was made; the amount of flow was probably not over half that of the sewage. As it flows just below through the estates of two gentlemen, it behooves the authorities to be very particular as to the character of the effluent.

The precipitants used are lime and sulphate of alumina, about five grains of lime and seven grains of the sulphate per gallon. Contrary to the usual practice, the lime is added last. The sewage, however, as received is alkaline. The sulphate of alumina, after solution in water, is run continuously into a vertical cylindrical tank, through the bottom of which the sewage constantly flows, entering one side and passing out through the other. A vertical shaft with radial arms stepped in the bottom of the tank, by its revolution, thoroughly mixes the chemicals with the sewage. Farther on the milk of lime is mixed with the sewage in the same way. One or more extra vessels are dissolving the lime while one is being discharged into the mixer.

The precipitation tanks are worked continuously, each one independently. The sewage is about six hours in traversing the length of the tank (140 feet), and the effluent flows off at the lower end in a thin sheet, the width of the tank, into the channels leading to the irrigation fields. Each tank is cleansed after running one and one-half to two days. Brass walks, over which the sewage had to flow, were built at two-thirds the distance from the inlet end. But those

have been removed, and the tank works satisfactorily without them. Dr. Frankland recently stated that the tank effluent contains as little suspended matter as in more complicated constructions. The total capacity of the tank is not quite a million gallons. The effluent looks clear as it runs from the tanks, but has a decided color due to the sewage from some dye-works. This color is said to disappear after filtration.

The intermittent filtration area is only eight acres in extent, underdrained freely at a depth of five to seven feet, and cropped with Italian rye grass. It is composed of ordinary soil, and is much too small for the amount of sewage, which averages 275,000 gallons daily per acre, as is shown by the effluent being free from nitrates. Thirty acres more of land were about to be added.

The sludge at these works is pumped into the cylindrical receivers or montejus, and then forced to the filter presses from there by compressed air. After the compressed air in an emptied montejus has been turned into a full one till the pressure is equalized in the two (in the ordinary way) all the remaining air is forced over by pumping the montejus full of water from the bottom. Similar montejus are in operation in East Orange, New Jersey. While there is some economy in this method, it seems to me doubtful if it can pay for additional machinery and complications. The sludge presses used here have square instead of round plates, which for the same diameter turn out nearly a third more sludge cake; the grooves being all vertical and discharging at several points into a horizontal pipe, they drain the cake more promptly. About 6,000 tons of sludge cake are made per annum, costing 60 cents per ton—eight and one-half tons of cake per million gallons. This cake sold pretty readily, Coventry being distant from any large town, for 24 to 36 cents per ton when the supply was only 3,000 tons per annum. But the market is now somewhat over-stocked, with a tendency of the sludge to accumulate. Quite a pile was in stock at the time of my visit in June, which, however, was not offensive. The whole works are quite free from bad odors.

A revolving screen, Latham's patent archimedean extractor, like the one condemned at Chiswick, is in constant use here, and much liked. About 700 cwt. of solids is removed by it daily and sold as manure, for which I think a higher price is obtained.

The annual cost of treatment is about $15,700 per million gallons of sewage, amounting to a little less than 30 cents per head per annum.

LONDON.

The works for the treatment of London sewage are interesting, mainly from their vast magnitude, no other plant for chemical precipitation being at all comparable with this in size. Up to within about thirty years the sewage of the city, to the extent that it was admitted to the sewers, was discharged into the Thames along the city front. The extreme foulness to which this comparatively small river was reduced compelled a change, and between 1859 and 1865 intercepting sewers were constructed to convey the sewage to points eleven and fifteen miles below London Bridge before delivering it into the Thames. Over eighty miles of intercepting sewers were constructed in two independent systems for the two sides of the river, high and low level interceptors in each, the sewage from the low level being pumped into the high level. From the south side an outfall sewer 11½ feet in diameter and seven miles long conveys daily some 75,000,000 gallons to the outlet at Clossness, and for the north side three parallel horseshoe-shaped outfall sewers, each nine feet in diameter and one five miles long, discharge daily about 115,000,000 gallons at Barking, together nearly 200,000,000 imperial gallons daily, and this, too, at the rate of only thirty-five gallons per head. Although the sewage was only discharged into the Thames at flood tide and for a few hours afterward, and was stored in reservoirs at other stages of the tide, this immense amount of sewage continued to seriously affect the purity of the river for considerable distance above the outlets. In dry seasons the sewage has been traced nearly up to Teddington, some thirty miles above the point of discharge, and it oscillates for a long time in the river, by the action of the tides, before getting out to sea.

The works at Clossness for precipitation were not completed when I was in London, but I visited the larger works at Barking.

The chemicals used for precipitation are lime and copperas (proto-sulphate of lime), about four grains of lime and one of copperas being used per gallon. The lime used is not in form of milk of lime, but in a clean saturated solution of lime water. In this form it much more quickly exerts its full effective strength.

This lime water is made from supernatant water of the sludge pumped back to the lime house, and its volume is about five per cent. of that of the sewage. This lime water is run in a single stream into each one of the three outfall sewers, and the copperas which has been ground up and thoroughly dissolved in water is fed into each sewer farther on in the same way.

There are thirty-two settling tanks each thirty-two feet wide and one thousand feet long, their collective capacity being twenty million gallons. Two seven feet circular gates for each of the tanks admit the sewage from the three connected sewers. Time gates are easily and beautifully handled by hydraulic pressure. Each gate slides up and down on a hollow central column, as well as in guides, and the water pressure is transmitted through this column to the rain in the gate itself. The tanks themselves are very badly designed (from the assumption by the chemists of the board of engineering powers), in having such an excessive length with perfectly level inverts. The tanks were worked on the absolute rest system, two hours being allowed for settlement, and the sludge had to be shoved the whole length of this one thousand feet by the workmen. They are rather unnecessarily covered entirely with vaulting, making them anything but desirable for working in. The clarified sewage was drawn off by an oval telescopic wire in three parts, closed at the top by a fixed cap. The upper section was lowered from the cap, and continually lowered as the water fell, by haudraulic power, till its limit was reached. Then the second section was lowered in the same manner, and finally the third. These wires were worked for all the tanks by a single man in a long room, having a set of handles controlling the hydraulic power for each set of wires. Gauge staffs constantly indicated the level of water in each tank, and the height of each wire set, so that the operator could constantly keep the level of each wire below the water level. At the time of my visit these tanks were being converted into a continuous system, allowing two or three hours for the sewage to flow the one thousand feet of their length. This would deposit more of the sludge near the sludge outlet, where the sewage enters the tank, and flushing arrangements were to be applied for assisting in cleaning out the sludge.

The clarified sewage is drawn off into the old outfall tank, hold-

ing some thirty-five million gallons, from which it is discharged into the river about high-tide by submerged pipes.

The sludge is delivered to the sludge-house where a set of centrifugal pumps raise it into the settling tanks. After settling the supernatant water flows into a pump well from which it is pumped back to the lime-house, and the remaining sludge, still containing about ninety-one per cent. water, is pumped by another set of pumps, through pipes, to the tank vessels which take it out to sea. These steamships carrying one thousand tons or more each, have valves and outlets in their bottoms for discharging the sludge. When emptied the tank floor is of course above sea level. About ten thousand tons per week were being thus disposed of. With improved working Mr. Crimp, the engineer, expected fourteen thousand tons would be obtained. With the works running on both sides of the river there would be over three thousand tons of sludge per day to be removed. The cost of taking it out to sea is said to be ten to twelve cents per ton.

FRANKFORT-ON-THE-MAIN.

The last sewage works of importance which I visited were at this city. They were built by an English engineer, Mr. W. H. Lindley, and their operation is under his supervision. The management of the works struck me as being more systematic than any I had seen.

The sewage all flows by gravity from the city to the tank for treatment, without any pumping. Intercepting sewers are built on each side of the river for serving the two quarters of the city, the one on the right bank terminating in a double inverted syphon of iron pipes, opposite the works, for bringing the sewage to them. Both interceptors are connected with the outfall from the works to the river, to provide for any excess of rain-fall, or for other emergency.

The treatment of the sewage is simply one of chemical precipitation, the chemicals used being lime and alumino-ferric. The settling tanks, at present four in number, are covered, as well as the entrance gallery, by vaulting. The sewage as it enters this gallery passes first through the screen chamber for intercepting the more solid material. The space in front of the screens is divided longitudinally into three small chambers, at the entrance to each

of which is a gate, and in each of which are two long flat trays placed tandem. The sewage passes over these trays before passing through the screen. At suitable intervals the gate of one compartment is shut down, the flat trays taken out and emptied. Their contents are sold for about thirty-six cents per cubic meter (about twenty-five cents per cubic yard). The milk of lime and the alumino-ferric in solution are admitted to the sewage in the gallery beyond the screen, each delivered from a trough in several small streams and scattered by falling on a plank underneath. There are also a few baffle plates. The alumino-ferric is admitted a few feet in advance of the lime. The settling tanks, at right angles to the gallery, 270 feet in length, are each worked continuously. The sewage is admitted to them from valves a little above the bottom; and the sludge collecting in the gallery, occasionally flushed into the settling tanks through other gates at the bottom. The sewage is about five hours in passing through the gallery and tanks, flowing over a wire at the end of the latter. The sludge, which is periodically cleaned out of each tank, is pumped into open pits, from whence it is taken away in tight carts by farmers, without either profit or cost to the city. The sludge is pretty fluid and is pumped by hand by the carters themselves into their carts, occasionally stirring it up with long poles.

The effluent looks quite clear, much clearer than the river, as I saw it. At ordinary stages of the river it flows directly into it, but during high water it has to be pumped up to be discharged.

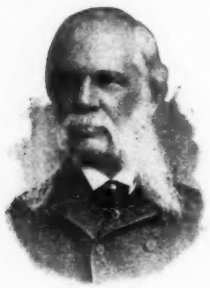
Both the lime and the alumino-ferric are ground up in pug-mills with water, and then diluted in open tanks, where the mixing or solution in the water is accomplished quickly and effectively by air being blown into the bottom of each tank through a circular pipe perforated with holes, causing a violent ebullition. The air is forced in by a steam injector, the stream mixed with air heating the solution considerably and materially assisting in the operation.

The milk of lime and the alumino-ferric in solution are conveyed in pipes to tanks in the entrance gallery where they are mixed with the sewage. Each tank is supplied with nine plugs.

A very simple and very systematic plan is followed in gauging the amount of chemicals to use in treating the sewage. There are nine pairs of beakers of varying sizes, but each pair having the

same ratio to each other. A definite amount of the inflowing sewage is poured into another glass vessel, and then a pair of beakers (selected according to the judgment of the attendant) filled respectively with the lime and alumino-ferric and emptied into the sample of sewage. If they precipitate the sewage in the vessel properly in a few minutes the pair of beakers is the correct one, if not, another pair is tried on another sample of sewage. The pairs of beakers are numbered from one to nine.

As I have already stated, the sewage flows to the station by two independent sewers. An electric indicator in the operating room is connected with floats in each of these sewers showing on dials the depth of sewage flowing in each, at any moment. A table which hangs upon the wall, shows from the two depths given on the dials the number of cubic meters of sewage flowing at any moment. Another table shows for this flow of sewage, and for the number of the pair of beakers used in the test of the sewage, the number of plugs in the tanks, holding the solutions of lime and alumino-ferric, which it is necessary to open in order to introduce the proper amount of the chemicals to the sewage of the quality and quantity then flowing.



J. Foster Flagg. Biographical Sketch in June Number, 1893, page 319.

The ordinary dry weather flow of sewage that is treated is from 30,000 to 40,000 cubic meters in twenty-four hours, say from eight to ten and one-half million gallons.

J. Foster Flagg.

THE DESIGNING OF A WATER-WORKS SYSTEM.

In designing a system of water-works, it is necessary first of all to determine what *source* of supply is available; if it can be from springs or a well, from a pond or lake, or from a stream. When the quantity is found to be sufficient then examine the quality to see if it is wholesome, or if it can be made so by proper treatment, and, finally, examine if the supply is liable to become contaminated and if any possible contamination is preventable.

The next question to be determined is whether the system can be a gravity system, or if the water must be pumped. Finally, if pumping is necessary, it must be determined if the distribution shall be by direct-pressure pumping, by a reservoir or by a stand-

pipe system. These questions being satisfactorily settled, the engineer should then make a map and profiles of the pipe lines, then prepare plans and specifications, with details of every part of the work, so that bids can be made intelligently and on a uniform basis by contractors wishing to perform the work. In addition, the engineer ought to furnish a list of materials and an estimate of the cost to do the work to comply with his plans and specifications.

TABLE OF STANDARD WEIGHTS OF CAST IRON WATER PIPE.

Diameter in Inches.	Thickness in Inches.	Weight, per foot length.	Lead, per joint, lbs.	Yarn, per joint, ozs.
4	1/2	22	6	7
6	1/2	33	8	9
8	1/2	43	11	11
10	5/8	66	15	13
12	3/4	93	18	18
14	3/4	117	22	20
16	3/4	125	24	22
18	3/4	150	26	24
20	7/8	197	28	28
24	1	250	32	32
30	1 1/8	358	38	38
36	1 1/4	480	50	44

All water pipe and specials are furnished coated inside and outside and tested to 300 pounds hydrostatic pressure per square inch before leaving the works. A variation of 5 per cent. of the above weights is allowed and paid for and should be included in making a preliminary estimate.

For preliminary estimate also allow 5 per cent. of the weight of pipe for the weight of crosses, tees, etc., for hydrants, street intersections, etc.

TABLE OF APPROXIMATE WEIGHTS OF CAST IRON PIPE AND SPECIALS PER MILE OF MAINS.

Allowing about 5 per cent. for overweights and wastage; also assuming weights of specials to approximate 5 per cent. of the weight of pipe.

Diam. of Pipe, Inches.	Tons of Pipe.	Tons of Specials per Mile.	Diam. of Pipe, Inches.	Tons of Pipe.	Tons of Specials per Mile
4 inch	61	3	16 inch	347	17
6 "	91	4.5	18 "	413	20
8 "	119	6	20 "	546	27
10 "	183	9	24 "	693	35
12 '	258	12	30 "	992	50
14 '	324	16	36 "	1330	66

It must be borne in mind that the above weights for pipe and

specials are only approximate and to be used only in making preliminary estimates of the probable cost of the proposed works.

TABLE OF PUMPING CAPACITY OF DUPLEX PUMPS.

Assuming a piston speed of 100 feet per minute for each piston.

Diameter of Water Cylinder in Inches.	Area of Water Cylinder Square Inches.	Capacity Per Minute—Gallons.	Capacity per 24 Hours—Gallons.
2	3.14	32	47,000
3	7.06	73	105,750
4	12.56	130	188,000
5	19.63	204	293,760
6	28.27	293	423,000
7	38.48	399	575,710
8	50.26	522	751,968
9	63.61	661	951,667
10	78.53	816	1,175,040
11	95.03	987	1,421,740
12	113.10	1175	1,692,000

The above figures are theoretical and considerably above the actual results. This is due to several reasons: The pump seldom takes full stroke; it does not always fill completely with water; the plunger does not fit perfectly tight and part of the water slips past the cylinder on the discharge stroke, and, finally, except for pumps with long stroke, a speed of 100 feet per minute is faster than the pump ought to work.

FIRE STREAMS.

Pressures required at nozzle; also friction through each 100 feet of 2½-inch rubber hose and gallons per minute for ring nozzles. Derived from Ellis' Fire Streams:

	SIZE OF NOZZLE.																	
	1 INCH.						1⅛ INCH.						1¼ INCH.					
Height of stream	50 ft.	60	70	80	90	100	50	60	70	80	90	100	50	60	70	80	90	00
Pressure at nozzle	24	29.5	35	41.5	48	57	24	29	34.5	41	47	53.5	23.5	28.5	34	40	46	53
Loss, 100 feet hose	3	4	5	5½	6	7	5	6	7	8	10	11	7.5	9	11	13	15	17
Gallons per minute	93	104	113	123	132	144	118	130	142	155	166	177	145	160	174	189	203	18

APPROXIMATE PRICES OF WATER-WORKS MATERIALS.

The following prices are approximate, but are close enough to use for making a *preliminary estimate* of the cost of a proposed system of water-works. With their use, city officials can determine about what can be accomplished with stated sums:

Cast-iron pipe, $30 per ton.
Specials, $60 per ton.
Lead, 4½ cents per pound.
Yarn, 5½ cents per pound.
Laying pipe, including lead, yarn, hauling, labor, tools, etc.:

Diameter.	Cost per lin. ft.	Diameter.	Cost per lin. ft.
4 inch	12—20 cts.	10 inch	23—31 cts.
6 inch	16—23 cts.	12 inch	27—36 cts.
8 inch	19—27 cts.	16 inch	41—53 cts.

VALVES.

Size.	Cost.	W'ght each.	Size.	Cost.	W'ght each.
4-inch	$ 8 00	116 lbs.	12-inch	$36 00	600 lbs.
6-inch	14 00	195 lbs.	14-inch	....	845 lbs.
8-inch	20 00	290 lbs.	16-inch	....	1080 lbs.
10-inch	28 00	440 lbs.			

Valve boxes, $4.50 each.

Hydrants—double-nozzle, to set five feet in the ground—without frost case, weight 375 pounds, $24 each; with frost case, 450 pounds, $28 each.

On the basis of these figures, it is perfectly safe to estimate the cost of the pipe lines complete, with ten hydrants per mile, using standard water pipe and allowing $75 per mile for valves, as follows:

APPROXIMATE COST OF PIPE LINE COMPLETE.

Diameter of pipe, 4 inches	Cost per mile,	$3,250
Diameter of pipe, 6 inches	" "	4,350
Diameter of pipe, 8 inches	" "	5,450
Diameter of pipe, 10 inches	" "	7,700
Diameter of pipe, 12 inches	" "	10,300

Assuming the carrying capacity of a 4-inch pipe to be 1, that is, if for a given pressure and length of 4-inch pipe it delivers, say, 100 gallons per minute, then the capacities of the larger pipes are the number of times greater, shown by the following factors:

Diameter of pipe, 4 inches	Carrying capacity,	1.00
Diameter of pipe, 6 inches	" "	2.75
Diameter of pipe, 8 inches	" "	5.65
Diameter of pipe, 10 inches	" "	9.90
Diameter of pipe, 12 inches	" "	15.60

The meaning of these figures is, for example: If a 4-inch pipe would discharge 100 gallons per minute, a 6-inch pipe would discharge 275 gallons per minute under the same conditions; an 8-inch pipe would discharge 565 gallons; a 10-inch pipe, 990 gallons, etc.

Pumping Station.—The cost of a building of simple design may be taken from $1,000 upward.

Pumping Machinery.—Owing to the great variety in the quality of pumps and boilers, and the different conditions met in every case, it is impossible to give any very close approximate figures for the cost of a pumping plant. A fair allowance for a pumping plant of one million gallons pumping capacity per 24 hours, consisting of a horizontal tubular boiler, feed pump, feed-water heater, piping and fixtures and a compound, duplex, non-condensing pump with foundations, all set up ready to use, will be $3,000.

Reservoir.—The cost of a reservoir of, say 500,000 gallons capacity, lined with concrete or hand-burned brick, may be placed at $2,500.

Stand-Pipes.—The cost of a stand-pipe may be placed at five cents per pound for the iron work and $5 to $7.50 per cubic yard for foundation of masonry or concrete. Approximately, a stand-pipe 12x100 feet, including foundation, will cost $4,000; and a stand-pipe 16x100 feet, including foundation, will cost $5,500.

Well Supply.—A water supply from wells will cost $1,000 and upwards.

Mechanical Filters.—The cost of a filtering plant, without aerating appliances, for cylinders of steel or iron plates, may be placed at $1,000 for each 100,000 gallons filtering capacity per 24 hours.

The prices given above being only approximate, their use will not furnish an accurate estimate; at the same time, they will enable city officials to form a conservative but safe opinion as to what a system ought to cost.

In conclusion, we claim that the truth must be evident to the mind of the reader, who may be interested in the construction of a water-works system, that it is absolutely necessary to employ the services of a thoroughly competent and experienced engineer to, first of all, develop a satisfactory and adequate water supply for the system, and then draw up plans and specifications preparatory to having the work done.

No cut-and-dried plan can be offered to fit every place. The conditions ought to be studied in each locality and plans modified to suit conditions found. *E. A. Rudiger, C. E.*

CURRENT INFORMATION.

PURE WATER QUESTION.

Various practical suggestions are offered, and many experiments made on the question of purifying water for domestic purposes. At last, it seems that success has been attained. The most important and scientific method is brought forward by Dr. Albert Woolf, and again New York's supply of Croton will undergo a process of purification. Electricity, which is put to so many strange uses, now, is the disinfecting and deodorizing agent in this great question of purifying Croton. The plant for treating the water has been located at Brewsters, N. Y., and consists of a dynamo capable of furnishing seven hundred amperes at a potential of five volts, a boiler, a steam engine,an electrolyzing tank and a storage tank.

To the water in these tanks is added a solution of chloride of sodium, bromide of sodium, sulphate of potassium, sulphate of lime, sulphate of magnesia and chloride of magnesia. The passage of an electric current through the water, changes the chlorides into hypochlorides and the bromides into hypobromides, and the liquid thus treated is discharged into the natural stream, which conveys water from the Sodom reservoir to the Croton reservoir at the head of the old and new aqueducts. The contact of hypochlorite of sodium with any organic matter causes instant decomposition, and makes the water absolutely pure and free from all discoloration. The plant is designed to treat sixty million gallons a day, but it is proposed to treat at present from thirty million to forty million gallons per day. Ten grains to a gallon of water will be used of the three per cent. solution of salt and water, after electrical treatment. The treatment is designed for use from about the middle of June to the middle of September, as Croton is believed to be one of the best water supplies in the world, and needs no purification, except during the summer months.

Another method, on a far different scale has been solved by B. B. Buckhout of Saginaw, Mich., for the purification of Saginaw River water for domestic purposes, which is not only novel and simple, but perfectly feasible and comparatively inexpensive. Mr. Buckhout has a model which shows a succession of five sand filters, the first showing Saginaw River water in its original state, and percolating through the layers of sand from one to the other until the last contains as pure water, to all intents and purposes, as could be found anywhere. Mr. Buckhout says: "I have advocated this system for Saginaw for some time, and have no reason to doubt its efficacy. It would not cost over $1,000 to place a line of these filters at the inlet to our water supply, and you can see for yourself what a pure article we could get. Saginaw River water, were it not for its roily condition and accumulation of earthy matter, is as pure as we could wish to have for drinking purposes, and it is far ahead of the average well water. The system, which is perfectly practicable, would give us

the pure article unadulterated with earthy substances, and sweet and palatable." Mr. Buckhout's plan meets with the hearty approval of nearly all who are in a position to understand the bettering of this necessary adjunct to every household.

A device has been in use in San Francisco, Cal., for two years, which is very successful. It is a process of filtration through sheets of asbestos covered with pure charcoal, by percolation, no pressure being used, from which the water comes absolutely pure, limpid and sparkling. The cost is graduated to the needs of each consumer, and runs from one "frame" filters to twenty. The filters are covered with tin or fancy woods, and are kept clean and in order by the company at a moderate monthly rental.

PUBLIC WORK FOR IDLE LABORERS.

A movement, and one that can not be too strongly urged, has been started in Indianapolis and other cities to make street improvements in order to give employment to the idle labor during the present monetary stringency which has caused manufacturing establishments and shops to close down, throwing many thousands out of employment. With so many unemployed workmen, who are likely to increase in number, and who must be provided for, no way seems so good as to give them work, and, if public improvements are to be made, by all means make them while work is most needed. Indianapolis has not had that great army of unemployed workmen that other cities report, and it is largely due to the fact that men who have been heretofore wage workers are engaged in the public improvements now being made. Men who have been willing to work have been able to find it, at good wages, with the contractors for public improvements. The city contemplates awarding new contracts after those now outstanding have been fulfilled, that will keep the contractors and laborers busy until winter comes. The men who apply are persistent. About 60 per cent. of the wage workers in Indianapolis are stockholders in building associations, and 40 or 50 per cent. are paying for homes through the associations. Employers of labor claim that there is no city in the country where wage workers are better paid. Manager Kenyon, of the Western Paving and Supply Company, says "the public improvements have been the salvation of Indianapolis, and there are no idle men in the city." The men who are looking for work are not all residents of the city, but hundreds of them come here from Chicago, Kansas City and Cincinnati in search of work.

It is related at the office of one of the paving companies in Indianapolis that a citizen who has always opposed public improvements and who remonstrated when a pavement was put down in front of his property, called the other day and paid cash for the improvement. "I do this willingly," said he. "I have changed my mind in reference to public improvements. But for them the poor in the city would be besieging the churches, the charity organizations, and many would have failed to keep up their building association dues." Every effort should be exerted at this time, in all cities, to give work to their home laborers, and, that they and their families may derive the benefits of any scheme for relief that may be suggested, contractors should conform to the plan of restricting the men employed to those

who live in their cities and have families dependent upon them.

A GREAT THOROUGHFARE BRIDGE.

The new Sixth street bridge, recently completed at Pittsburgh, Pa., extending from Sixth street in Pittsburgh, across the Allegheny river to Federal street in Allegheny is a fine example of a roadway bridge. The specifications required that the new bridge occupy, approximately, the location of the old wire suspension bridge built in 1858–9, and that it be erected without interrupting to any great extent, the existing traffic. The new bridge has a masonry approach at the Pittsburgh end, 105 feet long, with two semi-circular arch openings of 28 feet span; two main river spans 44 feet between center of piers; one shore span, 48.5 feet over the Pittsburgh and Western Railroad on the Allegheny shore. The Allegheny masonry approach is the anchorage masonry of the old wire bridge with a new coping course added. The roadway over the whole structure is 40 feet wide between curbs, with a clearance between the trusses of 41 feet and 6 inches to give room for the hubs of the wheels. The sidewalks are 10 feet wide over the approaches and 9 feet clear of the end parts over the river span. The bowstring trusses are 439 feet three inches center to center end pins, 79 feet deep at the center; width center to center of trusses being 44 feet six inches. The street car tracks occupy the middle of the roadway and are 5 feet 2 inch gauge and 8 feet 8 inches center to center, leaving a clear space on each side of 12 feet for vehicles. The foot walks are of Seyssel asphalt ¾-inch on 2 inches of coal tar binder, and slope 2 inches in 10 feet toward the roadway.

The specifications required the floor to be proportioned for a live load of 100 pounds per square foot and a 30 ton load on two pair of axles 10 feet apart; the main trusses for 80 pounds per square foot over the whole structure. A dead load of 40 pounds for each square foot of sidewalk, and 130 pounds for each square foot of roadway must be provided for, in addition to the weight of metal in the structure. The superstructure is of steel and the total weight of metal in each of the main spans is 3,305,000 pounds. The street cars, which are operated almost entirely by trolley, were seldom blocked for more than a few minutes at a time during the building of the bridge. The total cost of the work is $560,000.

GOOD ROADS AT JACKSON PARK.

The National League for Good Roads is a new organization for the improvement of highways, and has at its head Senator Manderson for its president, and Gen. Roy Stone, of New York, for vice-president. The executive committee is composed of P. D. Armour and S. W. Allerton, of Chicago; Clem Studebaker, of Indiana; Chauncey B. Ripley, of New Jersey; A. J. Cassatt, of Pennsylvania; W. Seward Webb, of New York, and other men of like renown. Although the league has been organized but a short time, it has created quite an interest in this work, and has already secured the passage in the senate of a bill to organize a national highway commission. The object of the exhibits made by the league at Jackson Park is to convince farmers that they need better roads throughout the country, even if their taxes are higher for a year or two. At the south of the grounds, and close to the shore of the south

pond is a little square building with wide verandahs, and around the house are the sections of model roads, of which three styles of construction are shown in three widths of roadway. The first is 33 feet wide, with a stone bed 8 feet wide, and is a six-inch bed of macadam with fine stone and sand on top. The cost for a narrow roadway would be about $5,000 a mile. The second roadway is 41 feet wide, with a driveway of 12 feet. It is an eight-inch macadam, and would cost $6,000 a mile. The third is 50 feet wide, with a drive 16 feet wide, and is the Telford—eight inches of block stone with four inches of macadam and crushed stone on top, and would cost about $8,000 a mile. The roads are built so that face sections are exposed. They claim that the third style of road is desirable in soft clay or soil with a tendency to yield. While very expensive, it will last always. Just back of the league house a road will be shown that is suitable for very wet land. While visitors and farmers are interested in them and approve of them, the usual objections in regard to their cost are always offered. The object of the league is to meet and overcome these objections, by arguments, and pamphlets which are not only for the farmer, but for vehicle builders, horse breeders, merchants, manufacturers, insurance companies and bankers.

THE ENGLISH CHANNEL BRIDGE.

The English Channel bridge, about which so much has been said during the past few years, has again become a subject of much discussion in the foreign papers.

Preliminary calculations and estimates have been completed by the English company, whose proposition is to build a channel bridge that can be used for railroad as well as other traffic, who place the cost of the work near $160,000,000.

The original idea was to build the bridge on 121 piers, but the number is now reduced to 72, and will be built of steel, on the Eiffel skeleton system, so as to offer the least resisting surface to the elements. The object is to combine simplicity with the greatest possible safety. Alternate spans of 400 and 500 meters (or 1,300 and 1,600 feet) will be built, with the bridge arches high enough above the water level to enable the largest steamers and vessels to pass underneath with perfect safety during the highest high seas.

The quantity of masonry in the bridge, roughly estimated, is put by M. Fleury at 4,000,000 tons, and the quantity of structural steel at 1,500,000 tons.

It has not been decided, as yet, whether to have inclined approaches reaching far inland, or to build hydraulic elevators for lifting to the upper bridge levels railroad cars and other vehicles.

It is thought seven years will be required for the completion of the work, four years of which will be required in laying the foundations and building the piers, and the remaining three years to the erection of the superstructure.

SOME RECENT INVENTIONS.

An Apparatus for the Manufacture of Repressed Cement Pipes, 500,675. Clemens Schnell, Paterson, N. J. This invention consists in forming the pipe in a mold having a hollow core, while in a cool condition; secondly heating the core and surrounding the pipe to expand the core and enlarge the internal diameter of the pipe; thirdly artificially and quickly cooling the core, thereby contracting the same and reducing its external diameter, and

finally, while the pipe is still in its heated and expanded state, removing the same from the core.

A Street Sprinkler, 500,853. Charles A. Clark, Portland, Oregon. This invention comprises a water pipe, a rose sprinkler fixed thereon and having an overhanging shoulder, and inwardly and upwardly sloping and perforated sides, an adjacent block lying beneath the shoulder of the sprinkler and holding it from being driven downward, and a convex or dish-shaped cover hinged to the sprinkler and folding over and protecting the same.

A Land Leveler, 500,874. Wm. Falconer, Selma, Cal. This invention comprises a frame having a forwardly projecting shaft, a rear-wheeled axle upon which the rear end of the frame is mounted, a forward-wheeled axle with head-block and hounds, a false bolster secured to the top of the head-block, and in which the forward end of the frame shaft is journaled, a limiting bar mounted upon a king-bolt and passing through between the hounds, the guide being journaled in the front of the frame, a scraper carried by the frame, and draft connections between the scraper and the king-bolt of the forward axle.

A Brush for Street Sweepers, 500,906. John Jones and Alexander Gillies, Toronto, Canada. This invention consists of a series of steel strips bunched together and arranged in rows around a cylindrical frame, some of the strips being edgewise and other strips flatwise.

A Process of Disposing of City Garbage, 501,037. Horatio B. Arnold, Boston, Mass. This invention consists in first cooking the garbage in a closed vessel for a period of from four to eight hours, more or less according to the nature of its ingredients, and condensing all vapors which pass off during the cooking operation; then separating the solid matter or tankage from the water and grease; then pressing the tankage to separate an additional quantity of water, and then drying the tankage in a closed drier and condensing the vapors thus produced.

A Wheeled Scraper, 501,145. Ferdinand F. Hudel and Edward H. Liebenstein, Lake, Wis. This invention comprises a crank-shaped axle and supporting wheels mounted and capable of turning thereon, a scoop suspended by suitable hangers from the axle and a forked lever pivoted to the sides of the scoop near its front end and fulcrumed to and connected with the axle in line with the axis of the wheels by jointed rods having pivot connections at their ends with the lever and axle.

A Furnace for Burning Garbage, 501,181. Assigned to the Brown Developing Company, of New Jersey. This invention comprises a crematory furnace, a primary combustion chamber, a secondary combustion chamber having its floor composed partly of a solid portion and partly of parallel bars, a tertiary combustion chamber below the bars, and an escape flue below the solid portion of the secondary chamber and communicating with the tertiary chamber, whereby the gaseous products of combustion of the garbage and the refuse grease are thoroughly consumed.

An Apparatus for Mixing Asphalt Cement, 501,215. Julius Schubert, Brooklyn, N. Y. This invention comprises the combustion of a mixing vessel, a horizontal rotary shaft therein, radial arms attached to the shaft, and a horizontal agitating

blade on the arms provided with a flange on its inner edge.

An Apparatus for Repairing Asphalt Pavements, 501,536. Assigned to the Western Paving and Supply Company, Chicago, Ill. This invention comprises a series of burners and means for movably supporting the same in close proximity to the pavement.

A Method of Repairing Asphalt, 501,537. Assigned to the Western Paving and Supply Company, Chicago, Ill. This invention consists in subjecting the spot to be repaired to heat, adding new material, and smoothing and burnishing it.

An Apparatus for Treating Garbage or Like Wastes, 501,760. Assigned to the Chemical Garbage Reduction Company, Chicago, Ill. This invention comprises a retort having a supply hopper and discharge pipe, a fire box beneath the retort for heating the same, and means for supplying air in limited volume to the retort so as to restrict combustion therein and cause a charring of the solid portions of the garbage.

An Artificial Stone, 501,794. Marc Laffont, Paris, France. This invention consists in mixing plastic refractory argil with the fusible matter derived from igneous rocks, the mixture containing a minimum of fifteen per cent. of the plastic ingredient, and heating the mixture to a temperature above 1,250 centigrade maintaining the heat above that point until the material is transformed into a homogeneous crystalline body.

An Artificial Stone, 501,888. Marc Laffont, Paris, France. This invention consists of a homogeneous crystalline body composed of plastic refractory (apyrous) argil and igneous (eruptive) rocks, or the dust or debris thereof, the mixture containing a minimum of fifteen per cent. of the plastic ingredient.

Cement, 501,937. Elmer E. Hawes, Providence, R. I. This invention consists of a mixture of pine tar and rosin while hot with a mixture composed of glue, vinegar, salt and flour cooked together and added to the tar and rosin mixture, while hot, and sal-soda.

A Sewer Cleaning Apparatus, 502,130. Alfred Mundell, Brooklyn, N. Y. This invention consists of a guide comprising bars overlapped at their inner ends, keepers embracing the overlapped ends and each provided with a set screw to bind the bars in their adjusted positions, and a block supported by the bars and provided with an upward projecting frame having a pulley journaled therein to guide the operating cable.

V. H. Lockwood, Patent Att'y.
Indianapolis, August 20, 1893.

LEGAL DECISIONS.

Liabilities of Directors of Water Companies.—Where the statute provides that the capital stock of a company shall be paid into the treasury within eighteen months from the incorporation, and that if, by reason of the violation of any statute in relation to such company, it shall become insolvent, the directors ordering or assenting to such violation shall jointly and severally be liable for all debts contracted after the violation, and for the form of action against such directors. It is the duty of the directors to see that the capital stock is paid in as provided, and they cannot avoid liability for failure to do so by claiming that the treasurer failed to perform his duty. Clow *v.* Brown, Sup. Ct. of Ind., 33 N. E. Rep. 1126.

Power to Construct Sewers.—The law specifies two methods in which authority may be obtained by a board of village commissioners to construct sewers: one by special election, to determine whether sewers shall be constructed according to a general system proposed by the board; and the other by laws of 1891, which provide that whenever a petition for the construction of a sewer, to be paid for by the land specially benefited, is presented, signed by the owners of at least 500 lineal feet of land on any street through which a sewer is projected in the system, the board shall give notice of a time and place when they will hear persons for and against the construction of such portion of the system, and if, after hearing, the board shall determine to construct such portion, it shall proceed to enter into contracts therefor. The board can not, on being asked to construct a sewer in a certain street, go beyond the prayer of the petition and extend the sewer into other streets. Drake *v.* Board of Sewer Commissioners, Sup. Ct. of N. Y., 23 N. Y. Supp. 264.

Repeal of Grant of Right of Way by Municipal Corporations.—A city which has by ordinance granted to a street railway company the right to lay tracks on one of its streets may revoke such grant by repealing such ordinance, even after the track has been laid, when, in the judgment of the city council, the public safety and convenience and the proper regulation and use of the street require it. Such repeal gives the railway company no claim for compensation, where the track was laid after it had notice that the mayor would recommend the passage of the repealing ordinance as soon as it could be done. Lake Roland El. Ry. Co. *v.* City of Baltimore, 26 At. Rep. 510.

Damages for Change of Grade in Streets.—The fact that a street is raised above the grade of an intersecting street, so that vehicles can no longer pass from one to the other at that point, does not entitle a property holder owning land adjoining, though separate, lots, on each street, to damages for the lots on the intersecting street, but only on the lots abutting on the changed grade. Lawrence *v.* City of Philadelphia, Supr. Ct. of Penn., Feb. 13, 1893, 25 At. Rep. 1079.

Adoption of Resolution for Laying Out Streets.—The statute relating to the laying out of streets in a city provides that the city council shall, within sixty days after the commissioners of estimate and assessment shall have made their report, elect whether they will make the improvement, and the city charter provides that, if an ordinance presented to the mayor for his signature is not returned by him to that branch of the city council in which it originated before the end of the meeting holden next after the lapse of ten days subsequent to the presentation of the bill to him, the same shall be a law in like manner as if he had signed it. Where a resolution to lay out a street was presented to the mayor for his approval two days before the expiration of the sixty days, and became operative by reason of his failure to return it before the lapse of ten days, as provided by the charter, the election by the city council was not completed within sixty days, and the proceedings to lay out the street could not be sustained. *In re* Canal and Charles Sts., Supr. Ct. of R. I., Jan. 7, 1893. 25 At. Rep. 9750.

Provision for Repairs by Con-

tractor in Street-Paving Contract.—A requirement in a street-paving contract that a contractor shall keep the street in repair for five years imposes an additional burden on the property owners, and therefore vitiates the assessment made under it, unless such assessment requirement is authorized by the statute providing for the letting of contracts for street improvements. The objection as to the additional burden is not removed by testimony of the contractor that the requirement did not enhance the amount of his bid, as others might have bid a less sum if the contract had not contained such requirement. Brown *v.* Jenks, Supr. Ct. of Cal., 32 Pac. Rep. 701.

Constitutional Limitations of Municipal Indebtedness.—Where improvement bonds of a city declare that it acknowledges itself indebted to, and promises to pay the bearer thereof the sum of ..... dollars, lawful money of the United States, and that they are payable out of the proceeds of the improvement assessments chargeable on the property benefited, and that they are issued on the faith and security of such assessment, the city is bound absolutely for the payment of such bonds, though it might be reimbursed from the payment of the improvement assessments, and that they constituted municipal indebtedness, within the meaning of the constitution prohibiting a municipality from incurring an indebtedness exceeding five per cent. of the value of the taxable property therein. Fowler *v.* City of Superior, Supr. Ct. of Wis., 54 N. W. Rep. 800.

Compensation for Vested Rights.—The question as to what is just compensation for private property taken for public use is a judicial and not a legislative question; and the provision in the act authorizing the condemnation of a lock and dam belonging to the Monongahela Navigation Company that, in estimating the sum to be paid by the United States, the franchise of such corporation to take tolls shall not be considered or estimated, does not preclude the court from giving compensation for such franchise. The only authority which the United States has to condemn a lock and dam belonging to a corporation chartered by a State is derived from the power to regulate interstate and foreign commerce, and such power must always be subject to the obligation imposed by the Fifth Amendment, to make just compensation for private property taken for public use. The power of Congress over waterways connected with the great rivers of the country is supreme whenever it chooses to exercise the same, but, before it has acted, the legislative power of the state within whose borders the stream flows is competent to charter a corporation to improve the same, and to give it a franchise to collect tolls. A franchise thus granted is a vested right, and, if Congress thereafter, by condemnation, takes such improvements, it is bound to make just compensation for the value of the franchise as well as for the physical property taken. The fact that Congress possesses supreme power does not cause a grant of such a franchise by the state to be a mere license which is revoked or annulled when Congress, in the subsequent exercise of such power, takes possession of the improvement. Monongahela Navigation Company *v.* U. S. Supr. Ct. Rep. 622.

PERSONALS.

Col. Geo. E. Waring, Jr., sanitary engineer of Newport, R. I.,

was married July 20, to Mrs. Louise Yates, of New Orleans, La.

Mr. W. H. Cruikshank has been appointed city engineer, West Duluth, Minn., to fill the place of A. S. Cooper, who resigned a short time ago.

John Stephenson, the well-known street car builder, died at his home on the Boston post road, New Rochelle, N. Y., July 31.

Mr. Julian M. Kennedy, of Pittsburgh, Pa., has been elected consulting engineer for the new waterworks company in Allegheny, Pa.

A company has been formed in San Leandro, Cal., to manufacture sewer pipe from paper and bitumen. It is a patent process, discovered by Mr. Bedbury, and many manifestations of enthusiasm are shown. A company with $10,000 capital stock and $10 shares was organized, the citizens taking one-quarter and Mr. Bedbury holding the balance. Work will begin on a rather small scale and the plant enlarged as it becomes necessary.

A scheme, which, if it proves to be successful, will probably be introduced in this country, is being developed in Scotland, by which a high grade of brick can be made from chipped granite and clay. Experiments and tests in the process have been successful, so far.

SELECTIONS FROM THE PRESS.

BRICK AND ASPHALT PAVING IN ST. LOUIS.

The comparative cost of various materials for construction of street pavements has been figured down to a nicety by an expert in a late issue of PAVING AND MUNICIPAL ENGINEERING, showing that the expense of Trinidad Lake asphalt for fifty years, including first cost of laying and interest, is 50 cents a square yard, against 28 cents for granite, 24 cents for cedar blocks, 26 cents for macadam and 17 cents for brick. According to the opinion of those best acquainted with the relative merits of different pavements, it is said that granite will outlast asphalt five years to one when laid on a concrete base. It is an open question concerning brick pavements for streets on which heavy teaming is accustomed to travel. The probabilities are that the estimate on the latter was made for lighter travel than the heavy teaming of the business streets of St. Louis. Leaving brick pavement out of the question, it will be seen from estimates made that all other materials in general use can be laid at less cost than Trinidad Lake asphalt. There are other considerations which should enter into the practicability of street pavements according to the locality. These are durability, freedom from noise and want of resistance. It is a demonstrated fact that cedar blocks are preferable for freedom from noise, and that the most slippery of all pavings now in use is the asphalt. The latter, it is said, has really but one advantage over all others, that is, less resistance to vehicles. But the difference in excess of cost is said to be by those who have had experience with Trinidad Lake asphalt, that its advantages are not equal to the cost of the material for paving.

A *Star-Sayings* reporter called

upon President McMath, of the board of public improvements, to ask about the article referred to in PAVING AND MUNICIPAL ENGINEERING of August. Mr. McMath had not read the article, and was not prepared to say anything about it. He said that brick pavement, properly laid, is about as good as an asphalt pavement in point of durability. He cited an instance of one street that was paved with brick, which had stood for fifteen years. He was asked to explain how the words "Trinidad Lake" happened to be inserted in the specifications and contracts for asphalt streets. In reply to this question Mr. McMath said that it was first done during the presidency of General Turner, who was an enthusiast on the subject of asphalt paving. At that time Trinidad asphalt was the only kind in use. He was asked why the words had not been taken out, and replied that it was because there had never seemed to be any necessity for it, the Barber Company being about the only company bidding on work in St. Louis.

"Mr. McMath, do the blank petitions for asphalt streets issued by the city to contractors state that the material used must be Trinidad Lake asphalt?"

"No; they do not. They simply state that the undersigned property owners and tax-payers petition the board for the improvement of this or that street. The material to be used is never printed in the petition."

"Then the contractors take these petitions and secure the signatures to them. The kind of asphalt to be used is inserted while the petition is in course of circulation?"

"That's right. The property owners who petition for the street are also responsible, directly or indirectly, for the insertion of the words 'Trinidad Lake asphalt.'"

"Suppose, Mr. McMath, that some property owners should petition for simply an 'asphalt street,' and not mention the kind of asphalt to be used, what would happen in that case?"

"Easy enough. The board would receive the petition and if it passed the board and the House of Delegates and became an ordinance, the board would have, of course, to establish some standard. All asphalt paving companies which sent in bids, which specified an asphalt up to the standard, would be given consideration and the company that furnished the best asphalt for the least money would be given the contract."

"What would you do with the words 'Trinidad Lake' in the printed contracts?"

"Simply take a pen and draw a line through them, in case another company got the contract, and write the name of the other company's material. That explanation is very simple, and, I hope, satisfactory."

"You have had nothing to do with the insertion of those words, which seem to create a monopoly for the Barber Company, have you?"

"Nothing at all. They were inserted before I entered this office, and we have had no new contracts and specifications printed since that time, so they still remain there."

"Suppose another company should come to St. Louis and attempt to secure contracts, what would be the result?" was asked.

"Either the Barber Company would freeze them out by bidding lower, even though they might lose money, or it would quietly and unobtrusively absorb the company

that had the audacity to bid against it. The Barber Company has the money and the grip to do that, and it would probably buy out the other concern. That's what they did in Omaha, where a company laid a pavement with another asphalt, and the pavement proved good. What happened? Why, the other company very mysteriously disappeared from the scene very soon after the contract was completed."

It is claimed by parties interested that procedure in the matter of street improvements is worked to the advantage of the Barber Asphalt Company. Property-holders in the vicinity of Cates avenue, near Goodfellow, it is said, can testify to the fact. An application, it is claimed, was recently made by the property-holders in that locality in due form, for the street to be paved with asphalt. It is alleged that the words "Trinidad Lake" have been substituted before the word asphalt since the petition left the hands of the property-holders. This is said to be not the first instance of the kind, but it is the one most recent. The informant said it would be impossible to say who altered the phraseology of the petition. The fact known is that the alteration was made.—*St. Louis Star-Sayings.*

AMERICAN ROADWAYS.

American roadways are a disgrace to civilization. This is saying a great deal, but is not saying too much. We are continually reading of brick paving in America, of material and of method, but we see nothing of its adoption—at least, in the great cities where it is most needed. The Britisher, with his incomparably perfect roads, as smooth as a billiard board, can not conceive a main thoroughfare, where apparently a lot of cobbles have been shot from a cart and allowed to find their own level. To cross an American roadway reminds one of the stepping-stones over a village stream. Our macadamized roads before being rolled are comfortable compared with the regular tracks in America.

How horses manage to pick their way among the irregular blocks of stone is a marvel. We presume they are bred to it, and a thing of this sort is nothing when you are used to it. But to get used to it one should be born in the States, and never leave there. A visit to the old country is apt to give much food for reflection to the American mind.

But if New York, Philadelphia and Chicago streets are bad, those at San Francisco are infinitely worse. Here locomotion is a standing prescription for people with a liver, and the tyro who ventures to ride in a buggy has perforce to be strapped therein, to prevent his being forcibly ejected from the vehicle.

One naturally inquires why it is that the big cities of the States have such execrable roads. One reason may be that there is no system in their management, and no local laws for their regulation; another, they are always being taken up and relaid, if such a term can be applied to them; and a third, that things are done with such hustle and bustle that they are only half done, and that badly.

Houses in the States are lived in before they are half built, and whole streets of "sky scrapers" are erected at lightning speed before a sidewalk or roadway, fit to be trodden by man or beast, is made.

And if the roadways are bad in the States, the sidewalks are worse. Planks of wood or huge paving stones are in some streets used, and

these are laid irregularly, and always with a view to imperiling life and limb. In Chicago, especially, there are huge gaping holes in the side streets at nearly every step, and pitfalls for the unwary in abundance. In England, the pedestrian is protected against himself; in America, woe be to the man who has bad sight, or who ventures home unattended after a night's conviviality. But here again we presume it is a question of custom, and an American, who has seen nothing better, and possibly something a great deal worse, thinks his streets perfection. It is amusing to hear a man say, "Come and see our street," when by some superhuman exertions a passable roadway has been made, as if it were a nine days' wonder. We can only say, that the meanest village in this country, or the lowest slum in London, would put to shame some of the finest thoroughfares of Philadelphia or Chicago.

There is a splendid opening in the big cities of the States for the utilization of vitrified brick, and if our clay-working friends can only induce the authorities to place a few paving contracts, they will soon possess roads worthy of their great country.—*British Clay-Worker.*

OUR FUTURE ROADS.

The continuous and serious consideration which has been given to the good roads question demonstrates in a very forcible manner the urgent necessity felt throughout the country for material improvement in our lines of highway communication. Even in portions of the country sparsely populated and possessing comparatively little wealth, the movement has met with distinct encouragement and an interest in it has been developed which increases with a continued examination of the question. It is true that there are portions of the country that may never be in condition to invest in the highest quality of highway construction and maintenance, but there is properly no portion, which will not at least indirectly feel the beneficial effects of the movement by a stimulation of road improvement to the highest degree possible under the existing industrial conditions of the communities interested. The great body of advantages, however, which is to result will accrue to the numberless suburban and rural communities which possess ample wealth for the construction of the very best highways, and whose members enjoy sufficient business capacity to realize the sound judgment involved in the investment.

Whatever enthusiasts may say about the necessity to any country of improved roads, the principles governing the expenditure are precisely the same as those which govern any business enterprise and the money can not be wisely applied unless the future benefits will justify the action. There can be no doubt that many sections of the country are already in a condition to be largely benefited by improved means of highway communication involving very considerable expenditures. This is not only true of populous suburban districts some of which have spent large sums of money on their roads, but also of many rural centers of population and of other sections of the country in which only improved main lines of highway between centers of business or between these centers and railway points would be justified. A rational system of education of popular sentiment and dissemination of reliable information regarding costs of the various grades and kinds of construction

are more needed than anything else at the present time. We are glad to observe that these desirable ends are being so well accomplished by such public bodies as the Massachusetts State Highway Commission, the Association of Highway Commissioners of the same state and by other similar bodies throughout the country.

The experiment of the state of New York in the construction of sketches of the best types of roads, by convicts, in the vicinity of the State penitentiary at Dannemora will, if properly conducted, aid materially in the same direction. All such "object lesson" work should be carefully systematized, and the most advanced methods of construction should be used; in fact, all the operations should be made identical, if possible, with those ordinarily employed in the usual types and grades of road construction. Rates of progress and accounts of costs should be accurately kept and then published with complete information regarding all the features of the work, so that reasonably exact estimates for other localities can be made from them. The visitation and inspection of the completed sections of roads in connection with this published information would constitute "object lessons" of a convincing character. Every State would do well to use all legitimate means in such education of its citizens, and thereby efficiently subserve its material interests. It is seldom that any movement has taken such a strong hold upon the public interest, and they have certainly been few of more real merit or destined to be of greater public benefit.—*Engineering Record.*

SEWAGE UTILIZATION.

Some important results have lately been obtained in the utilization of sludge from the sewage of London as a fertilizer. The enormous sewage of the British metropolis, poured into the lower Thames, caused such a nuisance that chemical treatment was adopted. This precipitated the solid matter in settling basins, leaving the liquid to run into the sea in a harmless condition. The solid matter, or sludge, was then taken far out to sea in steamers and dumped in deep water.

Last year the fertilizing qualities of this sewage sludge, pressed into cake, were given a test that demonstrated its value. Ten tons of it were spread upon poor, sandy soil alongside one area treated with the best farmyard manure, and another with artificial fertilizers. The best results were obtained from the sewage sludge and the worst from the artificial fertilizers.

This has started a demand for the sewage sludge on the part of farmers, and the metropolitan board of works, in charge of the London sewerage, has decided to press the sludge into cakes in proportion to the demand for agricultural purposes. No charge is made for it at present, and the farmers simply have to pay the cost of taking it away by water or rail. It is believed that ultimately a revenue can be derived from its sale as a fertilizer.

The London sewage amounts to 120,000,000 gallons a day, and this yields about 3,000 tons of settled sludge, which, by pressure into "sludge cake," can be reduced to about 900 tons. The economic value of this enormous quantity of material, hitherto wasted, applied to the land should be very considerable. Possibly the results thus obtained in London may point to a similar utilization of the solids

from our metropolitan sewage. Instead of running to waste in the bay, this sewage matter may ultimately become of great value to the market gardener about Boston.—*Boston Herald.*

WATER-PROOF MASONRY.

What was at first considered a doubtful experiment, viz., the use of coal tar as a means of rendering masonry impervious to water, especially in positions exposed to direct contact with the latter, has proved a practically valuable resort. Used as a coating for masonry built up of very porous stone, tar renders it quite impervious even at a depth of some fifty feet of water, and, according to the opinion of those whose experience has been extensive with it, the article should be utilized in all public buildings, particularly those designed for the preservation of works of art, the dissolving action of water, even upon mortar of superior quality, being well known, and also the unfavorable effect of the exudation of water charged with lime salts from the mortar. Two different methods of using the tar are named, viz., in a boiling state in one or several layers, this being suitable for surfaces exposed to the air, or it may be made to flame up before using, this being appropriate to surfaces which have to be covered up. It is stated that when boiling coal tar is employed in three coats on masonry the result is a black and very brilliant varnish, which perfectly resists the action of frost, water and sun, being likewise absolutely impervious; and the tendency of the black coating to absorb heat may be overcome by white-dusting the whole before the tar is quite dry.

MACHINERY AND TRADE.

A PRACTICAL PAVING BRICK DRIER.

The artificial drier needs no special introduction to the paving brick manufacturers of to-day; suffice it to say that the advanced and scientific methods, machinery and appliances now used have rendered it absolutely necessary to the modern plant, and the question at issue is solely what drier to obtain. In the matter of selection it is necessary for the manufacturer to thoroughly understand the properties of his clay and choose the drier that offers the best facilities for drying as its nature demands.

In view of the approaching fall—the period of improvements—and in anticipation of the manufacturers' needs—we submit a short description of The Standard Forced Draft Brick Drier patented and manufactured by the Standard Dry Kiln Co., of Louisville, Ky.

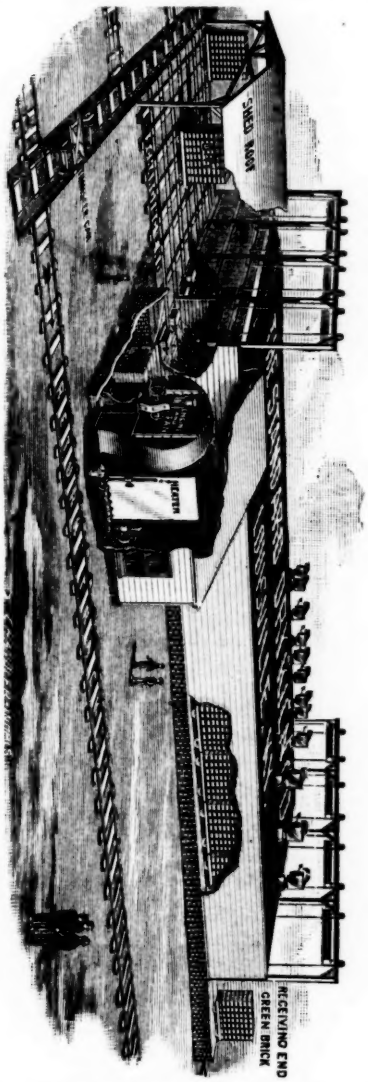
The accompanying illustration represents a four tunnel, eight track drier of the ordinary construction and equipment. The drier is situated so that the receiving end is next to the machine, from which the brick are loaded on cars and placed in the tunnels, on reaching the discharging end they are then transported to the burning kiln.

The system of drying is the steam heated forced draft, and the method of application, together with various patented improvements for the even distribution and control of the air, is effectual in the highest attainable degree.

A steel plate fan of the blower type, in connection with an improved sectional steam pipe heater

form the heating apparatus and furnish the air, temperature and circulation necessary to effect the desired results.

While the forced draft system of itself is extensively used, many in-



surmountable difficulties have to be overcome in drying by reason of its inability to control the hot air currents, which, on entering the tunnel immediately seek the highest plane and rise to the top. This condition if permitted to remain—and in the ordinary drier there is no remedy for it—results in a loss of time, increase in expense of operation and a serious injury to the clay drying.

To obviate these difficulties the manufacturers equip the Standard Drier with a patented system of floor piping extending longitudinally through the tunnels, above the floor and directly beneath the product drying. This being supplied with steam, generates a temperature at the floor line of any desired degree. The air currents entering the tunnel are thus equalized and the same degree of heat is maintained at bottom and center of tunnel as at the top. The most perfect results in drying follow.

One other important feature possessed by the Standard Drier is the method of ventilation. Two or more large, or a series of small, ventilating flues are so constructed with dampers that the water-smoke or moist air may be expelled at any point in the tunnel or retained the desired length of time, as the drying of shale, tough or plastic clays may require.

The drier is under the absolute control of the operater at all times, and as the drying agencies are subject to perfect regulation, the system affords a most practical and scientific treatment for the various clays for paving brick manufacture.

Great pains, study and years of experience with every phase and feature of the subject are embodied in the construction of the "Standard Drier," and its record for unsurpassed efficiency well merits the success it has attained.

For illustrated and descriptive catalogue, endorsements, and estimates, address the patentees and sole manufacturers, the Standard Dry Kiln Co., Louisville, Ky.

FRICTION CLUTCHES.

The latest catalogue of J. W. Penfield & Son is devoted to friction clutches, and gives much useful information on the subject, incidentally setting forth the advantages claimed for the clutch which they manufacture. On the subject of why friction clutches are desirable they say:

"The wisdom and economy of the use of friction clutch pulleys and couplings is already so universally recognized and appreciated that no extended argument in their behalf is required, but for the benefit of those who may not have given the subject thorough investigation, we will name a few of the most apparent advantages secured by employing these appliances.

"1st. Two motors can be used on one line of shafting, both working at the same time or alternately, as may be desired.

"2d. The line shafting is placed under immediate control. If necessary to stop the line shafting quickly, this can be done without stopping or slacking the speed of the engine or motive power. In case of fire, the line shaft can be disconnected from the motive power and all the power used for throwing water.

"3d. Any section or sections of the line shaft can be disconnected or connected instantly. In establishments with long lines of shafting this is an important feature, as should a belt break or accident occur in one portion of the works, the corresponding section of line shafting can be disconnected and stopped without stopping the entire line shaft or the engine. In many cases it is desirable to run only a portion of the plant at times, as when making repairs or changes in a part of the works, and in other cases it may be desirable to run a portion of the plant over time; in all such cases friction clutches are of decided advantage, for where a section of shafting is disconnected, all belts and pulleys stop, making a saving in wear of belting and bearings, and also saving the power that would be required to keep shafting, pulleys and belts in motion when not at work.

"4th. Each counter-shaft is under immediate and independent control, and can be stopped without stopping the line shaft or engine. This makes the power in each room independent of that in in the others, securing the same advantages as enumerated in the preceding paragraph.

"5th. Any pulley or machine can be instantly stopped without stopping counter-shaft, line shaft or engine.

"6th. The power can be applied to any machine gradually or abruptly as may be desired. If it is desirable to start a machine up slowly and not secure the full speed at the start, the friction can be gradually applied and increased until full speed is secured.

"7th. The use of tight and loose pulleys, with shifting and consequent added wear of belts, is avoided. Also, extra wide belts, too wide to shift successfully, can be used with clutch pulleys to the best advantage.

"8th. As the belts do not have to be shifted, tighter belts can be used, increasing the power transmitted and transmitting the power more smoothly and evenly.

"9th. Where the Clutch Pulleys are placed on the line shaft or counter-shaft (which is the most advantageous arrangement), each belt stops when its clutch pulley is thrown out of clutch, and the belting stands still when not at work. This largely decreases the wear of

the belting, and also saves the power which would otherwise be required to keep belts and loose pulleys in motion.

"10th. Serious accidents are often prevented and danger to life and machinery arrested by the quick control which Friction Clutches afford over the power.

"In short, for driving all sorts of machinery, whether heavy or light, high speed or low speed, Friction Clutches afford immediate and perfect control over each pulley, machine, counter-shaft, section of line shaft, or line shaft complete, combining the highest degree of utility and convenience with the greatest economy of power, belts and bearings.

"In some quarters, the mistaken idea prevails that the initial expense of equipping a plant with Friction Clutch Pulleys is much greater than where tight and loose pulleys and driving pulleys with the necessary double width of face are used. The fact is, that taking into account the cost of loose pulleys and of extra wide driving pulleys (which are not required where Clutch Pulleys are employed), the initial cost of an equipment using Clutch Pulleys is but slightly, if any, in advance of the other (and admittedly inferior) arrangement, while, in some cases, by using Clutch Pulleys, the cost is even less. Even if this were not the case, it is obvious that the advantages afforded by Clutch Pulleys would soon compensate for the additional cost, and consequently the matter of first cost should not deter any one from equipping their plant throughout with friction clutches."

BRICK-MAKING BY ELECTRICITY.

It is now claimed that brick can be made by the application of electricity. The clay is tempered by passing an electric current through it, which disintegrates at the same time particles of iron, rock and other refractory substances. Bricks can be made from the mud and ready for the mason inside one day, and at a price so reduced that a brick house will be within the means of all who build.

It is claimed that the current applied to molded brick for three hours will give them a hardness which can not be attained in the kiln in three days, although heated to the greatest possible extent. More kinds of clay can be used by this process than could formerly be handled. Clay containing mineral substances, and more especially iron, has had to be rejected heretofore, because the heating of these substances in the burning of the brick caused them to crack, and in many cases fly to pieces. In the new process the presence of such minerals is a real advantage, because the action of electricity on the ores causes an intense heat which gives the brick a greater hardness than can be given clay free from minerals.

The only apparatus required, beside the plant used in generating the current, is a table covered with iron molds for the brick, the most convenient size being 8x14 feet, this being large enough to hold molds for one thousand brick. The molds have covers of iron, which, when the molds are filled with clay, are fastened down securely and the current applied, which imparts an intense heat to the molds and their contents. The covers are opened by an automatic arrangement when the brick are sufficiently burned; then the current is turned off and the brick are dumped into the piles of the manufactured article. With this process drying and burning kilns

are done away with, and the expense of generating the current necessary to accomplish this is very much less than the price of the fuel used in burning the kiln.

BRICKS FOR FURNACE LINING.

The difficulties met with in obtaining high temperature for steel making, which often causes the melting of the bricks which line the furnace, has been overcome by M. Lencauchez, who has invented a new brick as dense as granite, and rendered unshrinkable in use by a preliminary shrinking at a very high temperature. The brick is composed of 93 to 96 per cent. of magnesia, 1 to 3 per cent. of lime, 1½ to 2½ per cent. of silica, and ¾ to 1¼ per cent. of alumina and iron oxide.

NOTES.

The Andorra Nurseries of Chestnut Hill, Philadelphia, have issued a large and beautifully illustrated catalogue of their stock which is especially notable as the best in the country from which to select trees, plants, etc., for public parks. Copies of it can be obtained by addressing William Warner Harper, Business Manager Andorra Nurseries, Chestnut Hill, Philadelphia, Pa.

A description of the municipal sewage purification plants in the United States and Canada is given in a little volume, just published by the Engineering News Company, of New York. The author is Mr. M. N. Baker, associate editor of the *Engineering News*, and the volume consists of a series of articles which have appeared in that publication.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Nashville, Tenn., has appropriated $7,000 to be used in macadam paving.

Port Huron, Mich., has eleven miles of streets paved with cedar block.

Monroe avenue, east of Randolph street, Detroit, Mich., is being repaved.

Pasadena, Cal., has passed resolutions favoring the paving of four blocks of Colorado street with asphalt.

The city council of Lexington, Ky., is contemplating the paving of several of the principal streets with brick.

All of the streets in the business section, and some of the residence streets in Momence, Ill., are being macadamized.

Eight blocks of Twenty-fourth street, Portland, Ore., have been macadamized, which gives it the appearance of a boulevard.

The trustees of Geneva, N. Y., recently voted to pave Castle street, from Main to Poultney streets, with cobblestone, at a cost of $1,500.

The city council of Youngstown, Ohio, has passed resolutions declaring it necessary to improve Fifth street, between Oak and Himrod streets.

The mayor of Pine Bluff, Ark., is endeavoring to organize a part of that city into an improvement district, for the purpose of graveling and improving the streets.

Three and a half million dollars is the estimated cost of public improvements being made in Rochester, N. Y.; $472,660 is being expended on street improvements.

G. L. McKibben, civil engineer, Van Wert, O., writes that resolutions have been passed in that city to improve South Washington street by curbing, and to macadamize part of Water street.

The paving of Jefferson street, Memphis, Tenn., is being done with brick of a Tennessee make, which makes a handsome appearance. Memphis is one of the best paved cities in the south.

The proposition to bond the borough of Jenkintown, Pa., for money to make street improvements was successfully carried at the election recently held. Three miles of street are to be macadamized. When completed there will not be a foot of dirt left in the streets of borough limits.

H. H. Wagoner, civil engineer, Huntington, Ind., writes that the city council of that city has decided to pave 2,800 lineal feet of William street, and about 1,000 of Washington street, with Hallwood block.

J. Tudor Graves writes that fire proof sidewalks only are allowed within the fire limits of Fargo, N. D. The first one has just been constructed by the Fargo Tile Company of artificial stone, making a nice walk.

The work of repaving many streets in Pittsburgh, Pa., has been completed, and thirty miles of new paving will have been done when the summer is over. Nearly $500,000 have been expended on the street improvements.

The mayor of Philadelphia, who preferred Belgian blocks in the paving of Chestnut street, has decided to pave it with asphalt, in accordance with the unanimous petition sent up by the business men on that thoroughfare.

The common council of Detroit, Mich., has ordered paved, Perry street, Junction avenue and Buchanan street, cedar blocks on plank and sand foundation, and Sixteenth street, brick on concrete. The cost of paving ordered will amount to about $70,000.

The city council of Canton, Ohio, has passed a resolution declaring it necessary to improve Court street, from Tuscarawas to Seventh street, by graveling to established grade, constructing curbing for a sixteen-foot roadway, and paving with vitrified brick on a stone foundation.

Center street, in Rutland, Vt., is being paved by placing spikes in the wheels of the road roller, to break the hard surface of the road, after which a heavy drag is hauled over it to loosen the earth so that it can be carted away, then a road machine is used to round up the road, which is then covered with crushed stone and rolled hard and fine with the steam roller.

The repaving of River street, in Detroit, Mich., as described in the August number of PAVING AND MUNICIPAL ENGINEERING, is reported to be a thorough success. The street is as smooth as one paved with cedar block, and gives indication of withstanding the wear of heavy traffic for a generation.

.Elm street, from Madison avenue to Grant street, Youngstown, Ohio, is being paved. The finest cement is being used to fill the spaces between the bricks. instead of pitch, which, it is claimed, makes the pavement less slippery and is just as serviceable as pitch. A roller is used to even up the brick surface.

Wichita, Kan., is said to be the best paved city in the southwest. Douglas avenue, from Wichita street to Washington avenue, recently completed by the Barber Asphalt Paving Company, added to the paving finished on Main, Market and First streets, makes 84,349 square yards of the finest asphalt paving in the world. Besides this, the city has a lot of brick paving on the side streets, said to be second to none in the country for cleanliness and ease and comfort in traveling. The paving just finished on Douglas avenue is estimated at $78,884.40.

The board of public works has passed resolutions for the improvement of the following streets in Indianapolis: To grade and gravel roadway and sidewalks of Summit street, from Bates to Michigan street. Length 560 feet, width 35 feet. To grade and gravel roadway and sidewalks of Summit street, from Bates street to the first alley north. Length 158 feet, width 26 feet. To grade and gravel roadway and sidewalks of Gresham street, from Gray street to the first alley west of New street. Length 569 feet, width 50 feet. To grade and gravel first alley east of Bright street, from New York to Wabash street. Length 720 feet, width 15 feet. To grade and bowlder the first alley north of South street, from the first alley west of Noble street to the first alley east of East street. Length 554 feet, width 12 feet. To grade and gravel the roadway and west sidewalk of Fayette street, from Fourth street to a point 176 feet north of Third street. Length 234 feet, width 25 feet. To grade and gravel roadway and sidewalks of Fayette street, from point above to Third street. Length 176 feet, width 50 feet. To grade and bowlder the first alley east of East street, from South street to the first alley north of South street. Length 142 feet, width 10 feet. To grade and bowlder the first alley east of East street, from Rockwood street to the first alley north of South street. Length 112 feet, width 15 feet. To grade and gravel the first alley west of Noble street, from South street to Rockwood street. Length 272 feet, width 20 feet. To pave with brick, on concrete foundation, first alley west of Tennessee street, from Washington to Maryland street. Length 420 feet, width 15 feet. To pave with brick, on concrete foundation, the first alley west of Meridian street, from Washington to Georgia street. Length 810 feet, width 15 feet. To pave with brick, on concrete foundation, the first alley east of Pennsylvania street, from Chesapeake to Georgia street. Length 200 feet, width 20 feet. To pave with brick, on concrete foundation, the first alley north of New York street, from Pennsylvania to Delaware street. Length 390 feet, width 15 feet. To grade and gravel the roadway and sidewalks of Pleasant street, from Hester to St. Paul street. Length 639 feet, width 40 feet.

CONTEMPLATED WORK.

Alexandria, Va., contemplates making street improvements by paving.

Broadway and South Fifth streets will be paved in Quincy, Ill., this year.

About one thousand feet of Ontario street, Cohoes, N. Y., will be paved.

Broad street, Quincy, Ill., will be paved its entire length with vitrified brick.

The citizens of Faribault, Minn., will construct a number of cement walks soon.

Ashland, Wis., contemplates paving about eighteen blocks of Second street with cedar block.

Three quarters of a mile of Franklin avenue, Harlem, N. Y., will be opened and paved.

New Albany, Ind., contemplates the improvement of several streets by paving with vitrified brick.

North Fifth, North Fourth and River streets, in Zanesville, Ohio, will be paved with vitrified brick.

West Grand avenue, from Twenty-eighth street to Park Lane, Des Moines, Ia., will be paved with brick.

Lancaster, Pa., contemplates the paving of Main street, from Duke to Christian streets, with vitrified brick.

The city council of New Orleans, La., has resolved to pave a number of streets with asphalt, granolithic and gravel pavement.

Monroe street, from Eighth to Ninth, and Court street, from Twelfth to the city limits, will be graded and graveled at Paducah, Ky.

About ten miles of streets will be constructed, and a half-mile boulevard will be built along the north bank of the river at Muncie, Ind.

North Vermillion street, from Broadway to Main street, will probably be paved this fall at Streator, Ill., by a few public spirited citizens.

Syracuse, N. Y., contemplates paving South Geddes street, from Fayette to Elliott streets, with vitrified brick or Trinidad sheet asphalt; Elliott street to Stolp avenue, with sandstone blocks, and about 18,000 square yards of asphalt or brick pavement and 7,000 square yards of sandstone pavement.

Central avenue, from Twenty-fifth avenue northeast to Twenty-ninth avenue northeast, Minneapolis, Minn., will be paved with cedar block on a plank foundation.

Crown Point, Ind., contemplates the paving of Joliet, Ridge, Jackson, and, possibly, East and North streets with cedar block paving next year, making in all about a mile and a half.

The street committee of councils, Lancaster, Pa., will pave Marion street with vitrified brick on six inches of concrete and four inches of sand, which, with brick of four inches, will make a roadbed fourteen inches deep.

Bids are advertised for the improvement of New Jersey street, Indianapolis, Ind., by paving with Trinidad asphalt street pavement, laid on concrete foundation. For paving with cement the sidewalks of New Jersey street, and for paving with brick the sidewalks of McCarty street.

Covington, Ky., will have the following streets paved with brick: Scott street, from Eighteenth to Twentieth, 3,800 square yards; Garrard avenue, from Seventh street to Patton's subdivision, 2,500 square yards; Garrard avenue, between Seventeenth and Nineteenth streets, 4,100 square yards; Seventeenth street, between Scott and Greenup streets, 820 square yards.

CONTRACTS TO BE LET.

Proposals are wanted until September 11 for regulating and grading Fort Washington Ridge road, New York, N. Y.

Bids will be received until September 7 at the office of W. J. Scott, city secretary, Denison, Tex., for grading Main street.

Sealed proposals will be received by John Kindel, Elmwood Place, O., until September 5 for improving the streets by paving.

The city clerk of La Fayette, Ind., will receive sealed bids until September 11, 1893, for the improvement of Ferry street from Second to Fourth.

Sealed proposals will be received until September 4, Hamilton, O., for the improving of Millville avenue, by grading, graveling, curbing and paving with cement.

The city engineer of Johnstown, Pa., will receive sealed bids until September 4, 1893, for paving with fire-brick, Railroad street, from Adam street to its intersection with Center street.

Sealed bids are advertised at Marion, Ind., to be opened September 5, 1893, for the completion of the unfinished sidewalks on both sides of Sherman street, from Branson to Meridian streets.

Perry and Deatrich streets, Defiance, Ohio, will be improved from Worthington street to the northerly line of the track of the B. & O. railroad, in said city, and sealed bids will be received by the city clerk until September 19th.

Sealed bids will be received until September 8th, at the auditor's office, in Circleville, Ohio, for the rebuilding of that part of the Mackey Ford Road Improvement No. 20 lying between the Ohio canal and the Scioto river.

Bids are asked by Fred J. Sackett, Omaha, Neb., until September 11, for grading, as follows: Two thousand yards on the south side of section 36, town 16, range 11, Jefferson precinct; 4,000 yards on the south side of section 10, town 16, range 11, and 2,000 yards on the south side of section 11, town 16, range 11, Union precinct.

CONTRACTS AWARDED.

Elk City, W. Va., has let the contract for 6,000 feet of brick pavement.

Messrs. Jacob & Stewart received the contract for paving Market street, Sandusky, O., with brick.

The Rockford Construction Co. was awarded the contract for several blocks of streets in Aurora, Ill.

The contract for paving East Main street, Ionia, Mich., was awarded Woodcock & Neil, of Lansing, at a cost of $12,803.57.

Geo. L. Theobald was awarded the contract for 200 cubic yards of street improvement in Concord, N. H., at $4.50 per yard.

The Warren-Scharf Company was awarded the contract for paving Lincoln avenue, in Toledo, Ohio, with Berea curb, at $22,326.40.

W. J. Ernst was awarded the contract for 11,500 square yards of cedar block paving recently, at Port Huron, Mich, at 46 cents per square yard.

The T. B. Townsend Company was awarded the contract for paving, in Mt. Vernon, Ohio, with Hallwood block, at $1.60 per square yard, complete.

C. F. Lane, Berea, Ohio, writes that Berry & Davis, of Bellaire, secured the contract for grading, draining, curbing and paving Front street, at a cost of $14,931.52.

The standing committee on paving, Minneapolis, Minn., awarded the contract to Jas. E. Snyder, for cedar block paving: On Eighth avenue, 78¾ cents per square yard; Fifth street, 78½ cents; Grant street, 79 cents; Third avenue, 78¾ cents; Washington avenue, 78 cents, and Marshall street, 79 cents.

The contract for grading West Fifth street, Superior, Wis., was let to Baxter Bros. for $3,075.

Wheeler & Wilcox, of Terre Haute, were awarded the contract for paving Main street, between Meridian and Center streets, Brazil, Ind., at $12.96 per foot.

The city council at Columbus, O., awarded the contract for paving North Main street to the T. B. Townsend Company, of Zanesville, O., with Hallwood block at $1.60 per cubic yard.

The Standard Construction Company was awarded the contract for paving York street, Cincinnati, Ohio, from Third to Eighth, with brick, the work to be completed within sixty days.

The Barber Asphalt Paving Company was awarded the contract for laying asphalt on Pine street, between Ninth and Tenth, St. Louis, Mo. The work, consisting of spreading a coating of asphalt over the granite, to deaden the sound, is experimental, and if it meets with success it will be a great benefit.

J. T. Wyatt, of the J. T. Wyatt Granite Company, near Salisbury, N. C., writes that he has been awarded the contract for furnishing 11,500 square yards of rubble paving stones, and 5,000 feet of 4-inch granite curbing, for the city of Asheville, N. C. H. M. Smith was awarded the contract for the work to be done.

The board of public works, Saginaw, Mich., has awarded contracts as follows: Paving Washington avenue from Johnson to Janes street with brick, H. S. Hallwood, $26,460; grading Gilmore street, $391.76, and Cambrey street, $1,192.51, E. Jochim; grading Reed street, $21.32, and Youmans street, $84.50, Chas. Koth, and grading Van Etten street, McIntyre & Passmore, $71.89.

J. W. Sedwick, city engineer at Pasadena, Cal., writes that the contract for 110,000 square feet of asphalt paving on Fair Oak avenue and Raymond avenue was awarded the Perrine Paving Company, of San Francisco, at 31 cents per square foot. The city council also awarded to Gray Bros. Artificial Stone Paving Company the contract for 40,000 square feet of cement sidewalk, at 10⅓ cents per square foot.

Contracts have been awarded in Syracuse, N. Y., during the past month as follows: Paving Midland avenue from West Onondaga street to Corbin street, with Trinidad sheet asphalt, Syracuse Improvement Co., $72,443.80; paving East Genesee street, from Mulberry street to the city line, with Trinidad sheet asphalt, Warren-Scharf Asphalt Paving Co., $167,215.00, and paving about 1,700 lineal feet of James street, with Trinidad sheet asphalt, Syracuse Improvement Co., $20,070.68.

SEWERAGE.

The estimated cost of sewers being built in Rochester, N. Y., is $2,881,250.

Plymouth, N. H., has voted to raise the sum of $1,200 for sewerage purposes.

Rapid progress is being made in laying the Fayette street sewer at Peoria, Ill.

The city council at Nashville, Tenn., has appropriated $8,000 for a street sewer.

The citizens of Sidney, N. Y., have voted to sewer the village. Work will begin at once.

The city council of Ballard, Wash., has voted in favor of issuing $40,000 in bonds for sewerage.

An ordinance has been passed in Waukeska, Wis., deeming it necessary to construct a system of sewers.

The council at St. Joseph, Mo., has passed an appropriation of $25,000 to be expended on the Black Snake sewer.

The New Orleans Sewerage Company recently obtained a franchise to construct an extensive sewer system in that city.

A sewer is being constructed in Tacoma' Wash., running from the bay to South Eleventh street, at a cost less than $50,000.

The Melrose avenue sewer being constructed by Contractor Boehmer in New York, will be completed by November 1.

Morgan & Mitchell, of Kingstown, have completed their contract at Stamford, N. Y., which gives that place a complete system of sewers.

The city council of Rock Island, Ill., has ordained that a sewer be constructed in Sixteenth street, from the south line of Third avenue to Fifth avenue.

Permission will be asked of the legislature, when it meets, to issue bonds for the purpose of building sewers throughout the entire city of Portsmouth, Va.

An ordinance has been passed which divides the city of Coffeyville, Kan., into three sewer districts, with boundary lines established between each district.

Plans and specifications for a sewer system for Snohomish, Wash., have been completed. The plans call for nine and one-half miles of piping, and the total cost is to be $70,000.

F. F. Rogers, city engineer, Port Huron, Mich., writes that three pipe sewers are under course of construction in that city, aggregating nearly 5,000 feet. The largest is a 12-inch pipe, and all are lateral sewers, to connect with the trunk sewers already built. Port Huron has about nineteen miles of public sewers.

J. B. Hinchy, the contractor for the North Denver, the Capitol Hill and the South Side sewers, at Denver, Colo., will, in a short time, have 500 or 600 men at work. The contracts amount to $150,000.

The Tenth street sewer, in Bay City, Mich., is the cheapest ever constructed in that city, the total cost being about $5,000, an average of $15 per lot, 50x100 feet in size. The sewer is egg-shaped, 26x39 inches in diameter.

The street commissioner of Canton, Ill., has completed 661 feet of sewer pipe between avenues C and D on West Elm street, and now has a force of men putting in 431 feet of sewer pipe on West Chestnut street between avenues C and D.

Resolutions have been passed at Burlington, Ia., declaring it necessary to build a sewer, commencing at Division street and Central avenue, proceeding west to Marshall street, thence north to Sixth street, west to Garfield avenue and Leebrick street, and thence south to Etna street.

The following contracts for the construction of sewers have been awarded in Syracuse, N. Y.: East Onondaga street, from Salina to Mulberry street, 20-inch by 30-inch egg-shaped brick sewer, James Swift, $7,348; Oxford street, from Onondaga creek to Cortland avenue, 15-inch tile sewer, H. J. Hamlin, $752.50, and a 15-inch tile sewer in Warren street from Salina street to Onondaga street, M. Lavelle, $2,162.

CONTEMPLATED WORK.

A lateral sewer of 12-inch tile will be constructed in Tiffin, O.

Ellendale, N. Dak., is contemplating the construction of a sewer.

A system of sanitary sewers is contemplated at Clarinda, Iowa.

About 2,000 feet of sewer will be built along Fourth street, Delphos, Ohio.

Fargo, N. D., contemplates an extension in the lines of sewers in that place.

Hyattsville, Md., contemplates establishing a more general system of sewers.

The city council of Alliance, O., approves the plans for a new sewerage system.

The common council of Dowagaic, Mich., contemplates the construction of a sewer on Main street and Pennsylvania avenue.

Sewers will be constructed in Montreal, Canada, in Chenneville, Duluth, Dufresne, St. Famille, St. Hubert, St. Jean, Logan, Metcalf, Pautalem and Rachel streets.

A brick, iron and terra cotta pipe sewer will be constructed in Hanover street, from the east bank of Pennsylvania canal to center of Twelfth street, Harrisburg, Pa.

New Philadelphia, O., will have constructed, a 20-inch pipe sewer from Fifth to Sixth streets, an 18-inch pipe sewer on High street, an 8-inch pipe sewer from Third street to Fifth street, and a 24-inch pipe sewer in East avenue.

A system of sewerage will be constructed in Flemington, N. J., which will consist of five miles of pipe and eleven flush tanks, holding two hundred gallons each, and can be discharged every twelve or twenty-four hours. The cost of the sewer is placed at $37,431.71.

Sewers will be constructed at Youngstown, O., in Stull street between main sewer and Moore street; Plum street, between High street and Ridge street; Ridge street between Plum and Wallace streets, and in John street between School street and Plum street.

CONTRACTS TO BE LET.

Sealed proposals will be received until September 4 for the construction of a lateral sewer, Fargo, N. D.

Sealed proposals will be received by the village of Hinsdale, Ill., until Sept. 4, 1893, for furnishing material and labor for laying pipe and brick sewers in sundry streets.

M. T. Dozer, city engineer at Ashland, Wis., writes that the common council of that place has ordered the board of public works to let the contract for 4,700 lineal feet of vitrified sewer, 8 by 20 inches.

Sealed proposals will be received until September 5, for constructing 1,150 feet of 3½ foot brick sewer; 1,875 feet of 4½ foot brick sewer; 240 feet of 15-inch sewer pipe, and 40 feet of 18-inch sewer pipe.

Contracts for sewers in Watertown, N. Y., were awarded, recently, as follows: Clinton street sewer, P. Plunkett, $1,375.38; Cooper street sewer, J. & J. Goffney, $1,371.97, and Moulton street sewer, J. & J. Goffney, $5,660.82.

CONTRACTS AWARDED.

Darrow and Bates secured the contract for 84,000 feet of sewer in Oberlin, O.

Messrs. Westbrooke and Pistine were awarded the contract for building the Montclair outlet sewer, Montclair, N. J., for $26,889.

W. J. Irwin, of Greenville, Ohio, was awarded the contract for the West Bucyrus street sewer, at Crestline, O. The contract price is $2,039.45.

S. W. and A. B. Lee were awarded the contract for laying five hundred feet of sewers on Union street, Florence, Mass., and Contractor Marsden got the contract for two thousand feet on North Maple street.

Bids will be received until September 4 for constructing a main sewer on Fourth street, Fargo, N. D.

Contracts were awarded for the construction of sewers in Yonkers, N. Y., as follows: South Broadway to J. A. Murphy, $23,500; Mulford Street, McCue and McElmeel, $2,400; Vineyard avenue, Edward Kieley, $7,900.

H. Ward, Binghamton, N. Y., writes of the letting of two sewers in that city. One brick sewer on State street was awarded Wm. E. Conklin at $15,764. One pipe sewer on St. John avenue and Leroy street to J. C. Smith at $993.

The city clerk of Fergus Falls, Minn., writes us that the city council has awarded the contract for one thousand seven hundred and ten feet of tile sewer to James McCrossin, at a cost of $1,624.50 or ninety-five cents per foot.

The city clerk of Alliance, Ohio, advertises for sealed bids to be opened Sept. 7, 1893, for furnishing all materials and performing all labor necessary for constructing east side main sewer No. 2 and west side main sewer No. 3.

E. Bartow, of Port Huron, Mich., was awarded the contract for constructing the remainder of the sewers for Dayton, O. The contract price for sewers in Districts 2, 3, 4 and 5 is $135,000. The price for the sewer in District No. 8, Dayton View, is $75,000.

Chas. W. Talcott has been awarded the contract at Woonsocket, R. I., for constructing a pipe sewer fifteen hundred feet in length. He also was awarded the contract for a 36-inch brick sewer one thousand feet in length and requiring 165,000 brick in construction.

Bick & Glann were awarded the contract for sewers at Galesburg, Ill., as follows: 48-inch 2 ring brick sewer at $5 per foot; 36-inch 1 ring brick sewer at $2.75 per foot; 22-inch vitrified pipe sewer at $1.75 per foot; 18-inch vitrified pipe sewer at $1.40 per foot; 15-inch vitrified pipe sewer at $1.20 per foot; 12-inch vitrified pipe sewer at 75 cents per foot; man-holes, complete, $30 each; catch basins, complete, $35 each; lamp-holes, complete, $2 each.

The board of public works, New Haven, Ct., has awarded contracts for constructing sewers as follows: Columbus avenue, from Washington street to Howard avenue, Nugent & Graham, $691.80; Chapel street, from James to Mill river, L. O'Brien, $1,313; Hamilton street, A. Carroll, $257; Edgewood avenue, Sherman avenue and Winthrop avenue, A. Carroll, $3,878.20; Edgewood avenue and Western street, from Winthrop avenue to Reynolds street, L. O'Brien, $1,510.

WATER-WORKS.

Water-works are wanted at Wichita Falls, Texas, by the citizens.

The citizens of Manawa, Wis., are talking of putting in water-works.

Greenfield, Ind., will vote on the question of water-works September 12.

Bonds will be issued in Kingston, N. Y., for $550,000 to build city water-works.

The citizens of Carbondale, Ill., favor the construction of a system of water-works.

Hoquaim, Wash., has voted to issue $24,000 bonds for a new system of water-works.

The water-works plant under construction at Princeton, Ill., is nearing completion.

The city council of Somerset, Pa., is endeavoring to secure a system of water-works.

The city council of Stockton, Ill., has voted to establish a water-works system, to cost $14,000.

The water-works of Babylon, L. I., are completed, and the results of tests made are very gratifying.

Bonds to the amount of $10,000 have been voted for at Spooner, Wis., for a city water-works system.

The city council of St. Cloud, Minn., has passed a resolution in favor of the purchase by the city of water-works.

The contract for the construction of the water-works, Newman, Ga., was awarded to Howard Neely, Chattanooga, Tenn.

The citizens of Wenatchee, Wash., unanimously favor the bonding of the city for the purpose of securing a supply of water.

Surveys have been made at Colville Wash., for water-works, and to ascertain the most feasible point from which to bring the water.

A petition is being circulated and signed at Phillips, Wis., asking the city council to assess or otherwise provide for a system of water-works.

Howell, Mich., wants a system of water-works and about nine miles of pipe. They have plenty of water, and estimate their requirements at $39,000.

The city council of Boulder, Colo., has called an election for September 12 to vote on the issuing of $50,000 in bonds to complete the water-works system.

A new steam pumping apparatus, with a capacity of fifteen million gallons per day is urgently required at Montreal, Canada. The probable cost of the additions asked is estimated at $100,000.

A new Worthington pump was recently put into position at the engine house in Marinette, Wis., giving the water-works a capacity of 7,000,000 gallons of water daily.

The new water-works plant at Eldon, Ia., is about completed. The reservoir is finished, the foundation is laid for the power house and the digging of the ditches is going on.

The construction of the Middletown water-works, Middletown, Md., is progressing rapidly, pipes having been laid from the side of the reservoir to the eastern edge of town, a distance of two miles.

Henry Kelling, city clerk of Walla Walla, Wash., writes that the proposition to bond the city in the sum of $160,000, twenty years, semi-annual 5 per cent. gold water bonds, to construct a gravity system of water-works, was voted upon and carried, the vote being 793 for proposition and 245 against it.

The citizens of South Milwaukee, Wis., unanimously favor the construction of a system of water-works. Two propositions have been submitted, one to secure the necessary water supply direct from the lake, and the other to construct a dam across the creek a half mile from the lake and get the supply from the dam.

CONTEMPLATED WORK.

Reedsburg, Wis., is contemplating a system of water-works.

Livonia, N. Y., is contemplating a new system of water-works.

Danville, Ill., will have a system of water-works, costing $62,000.

Troy, N. Y., is to have a new water-works system that will cost $700,000.

The construction of a water-works plant is contemplated at Harriman, Tenn.

New Woodstock, N. Y., contemplates putting in a system of water-works.

The citizens of Soo, Mich., have voted in favor of spending $30,000 to improve their system of water-works.

Frank P. Cobb writes us that the contractors are figuring on bids for a pumping station and boiler-house for the Chicopee water-works, to be built above the Chicopee Falls, Mass.

M. J. Blanding, of Galesburg, Ill., writes of the contemplated construction of a storage reservoir for that city, with a capacity for 4,500,000 gallons. Approximately, it will require 12,000 cubic yards of earth work, 1,000 cubic yards of concrete, 150 cubic yards of brick masonry, 700 lineal feet of 16-inch cast-iron pipe, 350 lineal feet of 15-inch vitrified sewer pipe, 2,000 feet of B. M. pine lumber, two 16-inch check valves, six 8-inch gate valves, and two sluice gates.

CONTRACTS TO BE LET.

Sealed proposals will be received until September 19 by the board of public improvements of St. Louis, Mo., for the construction of a pumping station and two pumping engines.

Bids will be received until September 27, at Detroit, Mich., for the centrifugal pumps the driving machinery and the Babcock and Wilcox boilers for pumping plant, for St. Mary's Falls canal.

Bids will be received until 8 o'clock, P. M., September, 8, 1893, for furnishing material, labor and appliances necessary to complete one or more artesian wells, in the city of De Kalb, Ill. Specifications for same on file at the office of E. A. Porter, city clerk.

The department of water-works, Evansville, Ind., has devised a novel method of inviting plans and specifications for the building and construction of a water-works plant in that city, by which premiums will be paid for the best, second best and third best plans tendered, said plans upon which prizes are paid becoming the property of the city. The first is a premium of $1,000, second, $500 and third $250, and will be determined by the water-works trustees, the water-works committee of the common council and the mayor of the city. The plans must be submitted to the secretary of the water-works on or before October 1.

CONTRACTS AWARDED.

Colman M. Carver will construct a water-works system at Whitney, Tex.

A contract has been awarded at Hillsboro, Tex., for a system of water-works.

The contract for constructing water-works at St. Johnsville has been let to Small & Gallo, of Brooklyn, at a cost of $25,000.

A. Turner, of Wauken, Ia., and T. O. Palmer, of Caledonia, Minn., got the contract for putting in a water-works plant at Caledonia for $7,650.

The city council of Ballinger, Tex., has awarded the contract to build a system of water-works to M. P. Kelly, of La Grange, Tex., at a cost of $14,750, the work to begin within sixty days from time awarded, and to be completed in five months.

The following contracts were awarded at Fairport, N. Y., for the construction and furnishing of materials for the water-works system at that place: Hydrants, Ludlow Valve Co., of Troy, N. Y.; valves, Renssalaer Valve Co., Troy, N. Y.; pumps, boilers and connections, Geo. F. Blake & Co., New York; construction, Continental Construction Co., New York; stand-pipe, Ritter & Connolly, Pittsburgh, Pa. The entire cost of the system will be about $40,000.

BRIDGES.

The new bridge across Deer Creek, near Delphi, Ind., is completed and in use.

The new steel bridge being constructed at Leavenworth, Kan., will cost $750,000.

The structure of the new iron wagon bridge at Lanesboro, Minn., is about completed.

A stone arch bridge is to be constructed across the Sassafras river, in Kent county, Maryland.

John Burckhardt and John Damm will erect a bridge across the river at West Bend, Wis.

The new bridge at the Knaggs crossing, Owosso, Mich., is about completed. It will cost about $3,000.

Four 40-foot bridges will be built along the boulevard, between Wade and Garden parks, Cleveland, O.

The Muncie Bridge Company is erecting an iron bridge across the Elkhart river, near Ligonier, Ind.

A bridge is being built across the Frazier creek, a mile east of Rock Creek station, Ill., which will cost $1,000.

The construction of a bridge 500 feet in length and consisting of three spans is contemplated at Concord, N. H.

D. M. Northup, Golden, Col., has been awarded the contract for building a new county bridge across Bear creek for $296.

S. N. Hewitt & Co., of Minneapolis, have been awarded the contract for building a bridge across the Musselshell at Roundup, Ill.

The new steel foot bridge under construction at Memphis, Tenn., has seven spans and is 949 feet long. It will cost $7,000.

The contract for the new bridge across the Blue river at Wetherarld's Mill, Hebron, Ill., calls for its completion by September 15.

A new first-class combination bridge is being constructed across the Republican river at Oxford, Neb., and will cost less than $3,000.

The county commissioners, Wharton, Tex., have decided to construct a bridge over the Colorado river at a cost not to exceed $23,000.

Sealed proposals will be received until September 4, for the construction of a highway bridge over the Arkansas river, Pulaski county, Ark.

O. C. Chapin was awarded the contract for three bridges, aggregating $499, at Leavenworth, Kan. He will also get 14 cents for excavating.

The contract for the Station street bridge at Kankakee, Ill., has been awarded for $12,000, the stone work having been previously let for $6,100.

The new iron bridge at Lake Kampeska, and the one across the Sioux at Watertown, S. D., cost the county $4,137, and are considered well worth the price.

Three bridges are being built in Rochester, N. Y. Court Street bridge, at a cost of $160,000; Andrews Street bridge, $75,000, and Bronson Avenue wrought iron bridge, $6,700.

Sealed proposals will be received at the county auditor's office, Athens, Ohio, until September 22, 1893, for the construction of an iron bridge over Hocking river at Hockingport.

A bridge will be erected at Palo Alta to span the Schuylkill river at Mt. Carbon, Pa., for which proposals will be received until September 4, by P. J. Connell, Pottsville, Pa.

Wm. Jurgensmeier, of Pearl City, Ill., was awarded the contract for the big bridge over Yellow creek, near Kent. R. D. Wheaton & Co. got the contract for the iron work.

Bids will be received until September 4, for rebuilding Pine river bridge at Brainard, Minn. The bridge will be a combination of iron and wood, and will be a pile or pier bridge.

O'Ronagan and Kittitas counties, Kan., have been called upon to appropriate $1,000 each, for the purpose of constructing a bridge across the Wenatchee river at Leavenworth.

B. F. Layne was awarded the contract for the stone work on the new iron bridge to be constructed on the Covington road, near Crawfordsville, Ind. The stone work will cost about $3,000.

Bick and Glann secured contracts for four highway bridges over Cedar Fork Creek, Galesburg, Ill., at North Kellogg, North Prairie, North Broad and West Main Streets. Price, complete, $2,600 each.

Sealed proposals, for erecting two new draw bridges a .d one new fixed span over the Louisville and Portland Canal, will be received until September 12, 1893, at the United States Engineer's office, Louisville, Ky.

A bridge will be constructed across the Loup river, south of Dannebrog, Neb. Bids, which are opened on September 1, are required for wood, combination iron and wood and iron bridges, and 400 pound dead weight per square foot of its deck surface. This bridge, a partly completed 40-foot span steel truss bridge and the rebuilding of an old one will cost the city about $3,600.

R. D. Wheaton & Co., of Chicago, received the contract for the new iron bridge at Spicerville, Mich. The bridge will be 16 feet wide, with no wood work except the planks and side rails. Cost, complete, $355.50.

A new bridge is wanted at Spring Common, Youngstown, O., by the West Side Improvement Society, who recently waited on the board of commissioners and presented the claims of the taxpayers of the west side.

Bids are asked until September 4, for the construction of a wagon bridge across the Yellowstone river, near Livingston, Mont. Bids are requested on both iron and combination bridges, with iron tubular and crib piers.

A bridge of two spans, the east span to be 90 feet and the west span 100 feet over all, and 16 feet wide, will be constructed over Ford river, near Escanaba, Mich. Bids will be received until 7 o'clock P. M. September 4.

Jayne & Son have completed the bridge on West Third street, Davenport, Ia. It is of the steel girder type, 60-foot span and is carried upon steel caissons filled with concrete. It has a carrying capacity of 360 pounds of live weight.

The Indiana Bridge Company of Muncie, Ind., recently built a new iron bridge over Anderson river, 250 feet long, 40 feet high and has a capacity of 450,000 pounds. The bridge was received by the commissioners of Spencer and Perry counties, jointly.

The new bridge at Westerville, O., will be a fine structure. The abutments are 4 x 2½ x 2 blocks of Berea sandstone. The bridge consists of an iron structure, of one ninety-five foot span and a double roadway twenty-eight feet wide and two sidewalks six feet in width.

Contracts for the construction of county bridges were awarded at St. Charles, Mo., recently. The Boenker bridge, near St. Peters, to Stupp Bros. Bridge and Iron Company, of St. Louis, for $275; a 100-foot span across Dardenne creek, awarded the same company, for $1,400.

The cost of the iron work to be used in the construction of the High street viaduct, Columbus, O., will be $69,000. There are four spans of 17 girders each, 76 feet long and 4 feet 2 inches deep. The width of the roadway is 65 feet, the total width of the bridge, including sidewalks, being 83 feet.

Abner Genier, city clerk, Delaware, O., writes that the contract for the bridge across the Olentangy River was awarded the Toledo Bridge Company, of Toledo, O., at their bid of $10,860. The bridge will be one span of two hundred and twenty feet, thirty-four feet wide, with two sidewalks.

Three new bridges will be built at Dayton, O. Two hoist bridges, one at First and one at Second street, will be 40 feet clear span, with a single roadway, 50 feet in the clear, with 10-foot sidewalks. The third bridge, across the Miami at Main street, will be 95 feet clear span, with a single roadway 38 feet in the clear and 8-foot sidewalks.

A footbridge will be erected at Lincoln Park, Chicago, which will cross both the lagoon and the lake shore drive. The bridge will be located at the foot of Webster avenue and will be of iron and wood. The span across the lagoon will be 170 feet, and the entire length of the structure will be 421 feet. It will be lighted by electric lights and will cost $20,000.

The contract for the superstructure of the bridge over the North Fork, east of Hoopeston, Ill., was awarded the Youngstown Bridge Company of Youngstown, O., for $1,109, and the contract for the substructure was awarded William Silver, of Hoopeston, for $9.25 per cubic yard and 25 cents per yard for the necessary excavations. The entire bridge, with the exception of grading, is to be completed by November 1.

Bids will be received until September 4, by Hon. W. A. Compton, Little Rock, Ark., for the construction of the Arkansas bridge, which will contain six spans, and will be 1,680½ feet long. It will consist of a masonry wall, 100 feet long, with retaining walls on the outside, 294 feet of iron trestle work, one cantilever span of 180 feet, a channel span of 360 feet, two deck spans 246 feet, a deck span 184½ feet, and one of 84 feet, and 189 feet of iron trestle, with side retaining walls.

Two new bridges will soon connect the east and west sides of Milwaukee. The Holton street bridge will cost nearly $150,000, the superstructure of the viaduct alone costing $40,700, the contract for which has been awarded the Wisconsin Bridge and Iron Company, and the substructure is being built by Thomas R. Bentley at a cost of $36,000. The Folsom street bridge, substructure and superstructure has been awarded the Wisconsin Bridge and Iron Co. for $58,567.

A new bill has been introduced in Congress by Senator Davis, of Minnesota, to construct a bridge to connect Connor's and Rice's Points, Superior, Wis. A change is made in the length of the draw, in the new bill, which is 444 feet instead of 350, allowing 200 feet in the clear on each side of the pivotal pier. The plans show a steel structure, providing for a steam railway in the middle, a walk for pedestrians on either side and a place for street railway and team traffic still farther to the side, one for going and the other for returning traffic. The bridge is estimated at $250,000.

STREET LIGHTING.

An election will be held September 13, to vote on issuing $11,500 electric light bonds, Ballard, Wash.

Proposals are wanted until September 7 for constructing an electric light and power plant at West Troy, N. Y.

The municipal council, London, Eng. invites bids until December 30, for lighting the city of Launcester, Tasmania, by electricity.

The city council, Richmond, Ind., gave the contract for constructing the commercial municipal electric light plant to O. C. Irwin & Co., of Greenfield, Ind.

The common council at Rahway, N. J., awarded contracts for lighting the city until the first of July, 1894, to the Rahway Gas Light Co., and the New York and New Jersey Globe Gas Co.

The Hancock Light and Power Co., of Findlay, O., has been awarded the contract for one hundred or more arc lights for lighting the city for the next five years at a cost of $69.50 each per year.

A. D. Huesing, city clerk, Rock Island, Ill., will receive sealed bids until September 4, 1893, for lighting the streets of that city by electricity. The term of contract to be five years from December 1, 1893.

PUBLIC PARKS.

Streator, Ill., will have a new park.

Efforts are being made to provide Walla Walla, Wash., with a city park.

Many thousands of dollars in contracts have been awarded for improving Van Cortlandt Park in New York.

Saginaw, Mich., wants a park. The citizens are making an earnest effort to secure a piece of ground for this purpose.

A sub-committee of the committee on sewers and drains recently held a meeting in regard to a new park for Elmwood, Mass.

Two wealthy citizens of Pittsburgh, Pa., have made handsome donations to Schenley Park, which will be used in improving it.

A committee has been appointed to confer with the leading citizens of the city in order to obtain their views on the movement for more new parks in Indianapolis.

The citizens of Columbus, O., are endeavoring to obtain grounds north of the city, known as the "Villa," for a park. Its beautiful scenery, running water and convenience to the street car line would make it the prettiest park in that city.

Forty acres of ground, with the right of way to it from several directions, has been offered the city of Fitchburg, Mass., for a park, by Henry J. Coggshall, president of the Fitchburg Gas and Electric Light Company.

Plans for a system of parks in Kansas City, Mo., have been completed, and President A. R. Meyer reports that drawings and surveys are being made and formal action will be taken on them about the middle of September.

STREET RAILWAYS.

A street railway will be constructed in North Main and Furnace streets, Akron, O.

Ashland, Wis., will extend the electric street railway of that place, one and three-quarter miles.

Preliminary surveys have been made for an electric road from Centre Waterboro to Limerick, Me., a distance of ten miles. The estimated cost is $80,000.

An extensive street railway system is proposed by the Montreal Park and Island Railway Company, Montreal, Canada. The lines will run from the city to neighboring municipalities and is proposed to carry freight as well as passengers, and possibly a mail service will be arranged between the suburban towns and Montreal.

S. Rusling Ryno, Rahway, N. J., writes that the Rahway Electric Street Railway Company is progressing rapidly. The road will run through the principal streets of the city, and will connect with Woodbridge and Sewaren, which latter place is a summer resort on Staten Island Sound. The road will be about seven and a half miles long.

MUNICIPAL BONDS.

F. B. Wells, Washburn, N. D., invites bids until September 4 for the purchase of $21,500 of bonds.

Bids are invited until September 4, Reading, O., for the purchase of $5,000 of five per cent. water bonds.

Bids are invited until September 4, by T. C. Frost, Carthage, Mo., for the purchase of $4,000 of 5 per cent. sidewalk bonds.

E. O. Buchanan, Lockland, O., invites bids until September 12, 8 P. M., for the purchase of forty bonds of $500 each; interest, five per cent.

Sealed offers to purchase thirty thousand dollars of the bonds of the city of Ann Arbor, Mich., will be received on or before the first Monday of October, 1893, by the city clerk, William J. Miller.